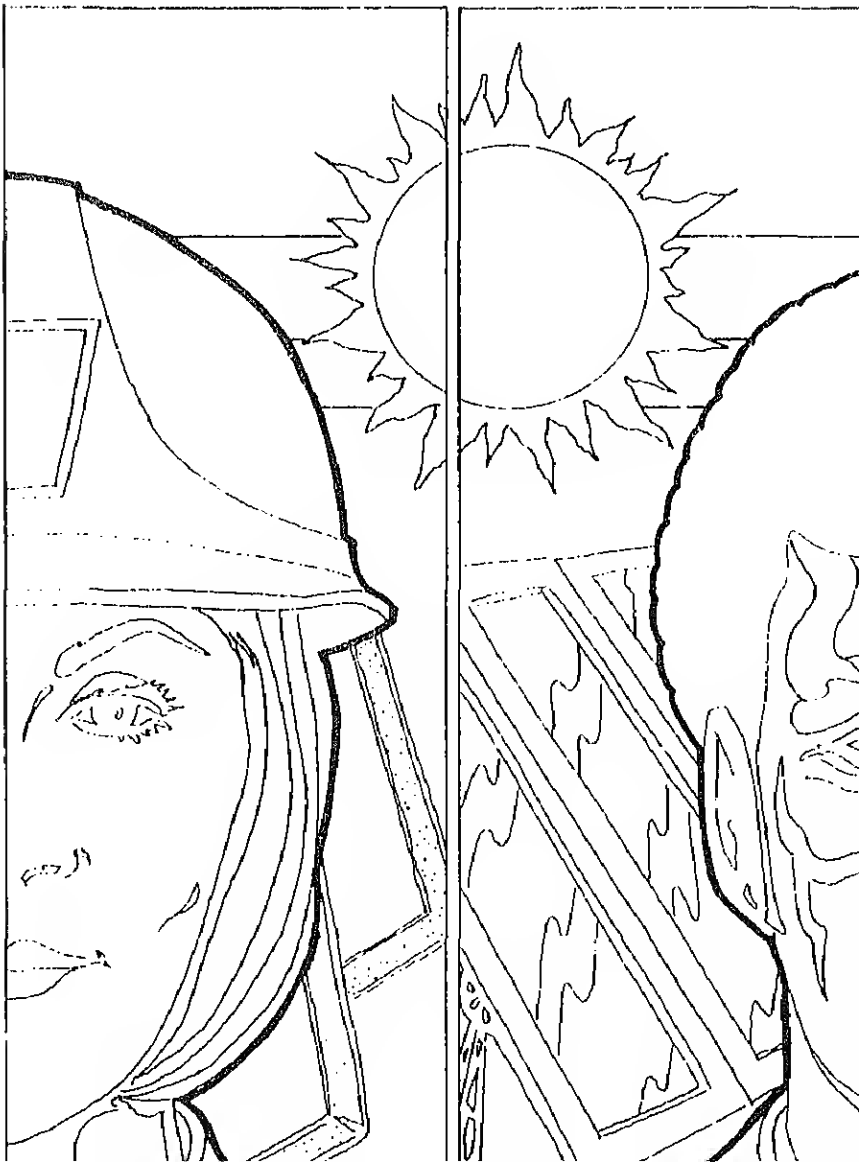
# Creating Jobs Through Energy Policy



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o policy decisionmakers both in defining the scope of their evaluat
as in determining the availability and cost of information necessar
ask.

I fully recognize that the material in this handbook is terse, and
antial effort on the reader's part to work through. The nature of
evaluation is such that there is no simple, step-by-step presentat
e used in all situations. However, this handbook will be periodica
ed--both to take account of new data bases or methodologies, as wel
ve the overall presentation of material. For this purpose, readers
nts on the usefulness of this handbook for their particular policy
ost welcome. Furthermore, policy analysts or decisionmakers who w
his handbook in developing employment impact studies may feel free
ct me for assistance.

Many individuals provided valuable input in completing this project
of the major reviewers are listed in the handbook as "personal cont
s that deserve special mention are Michael Kieschnick and Gregg Fe
project evolved from an idea originally suggested to me by Michael
helped me develop the methodology for determining informational re
in Section I.

Meg Schachter
Project Director
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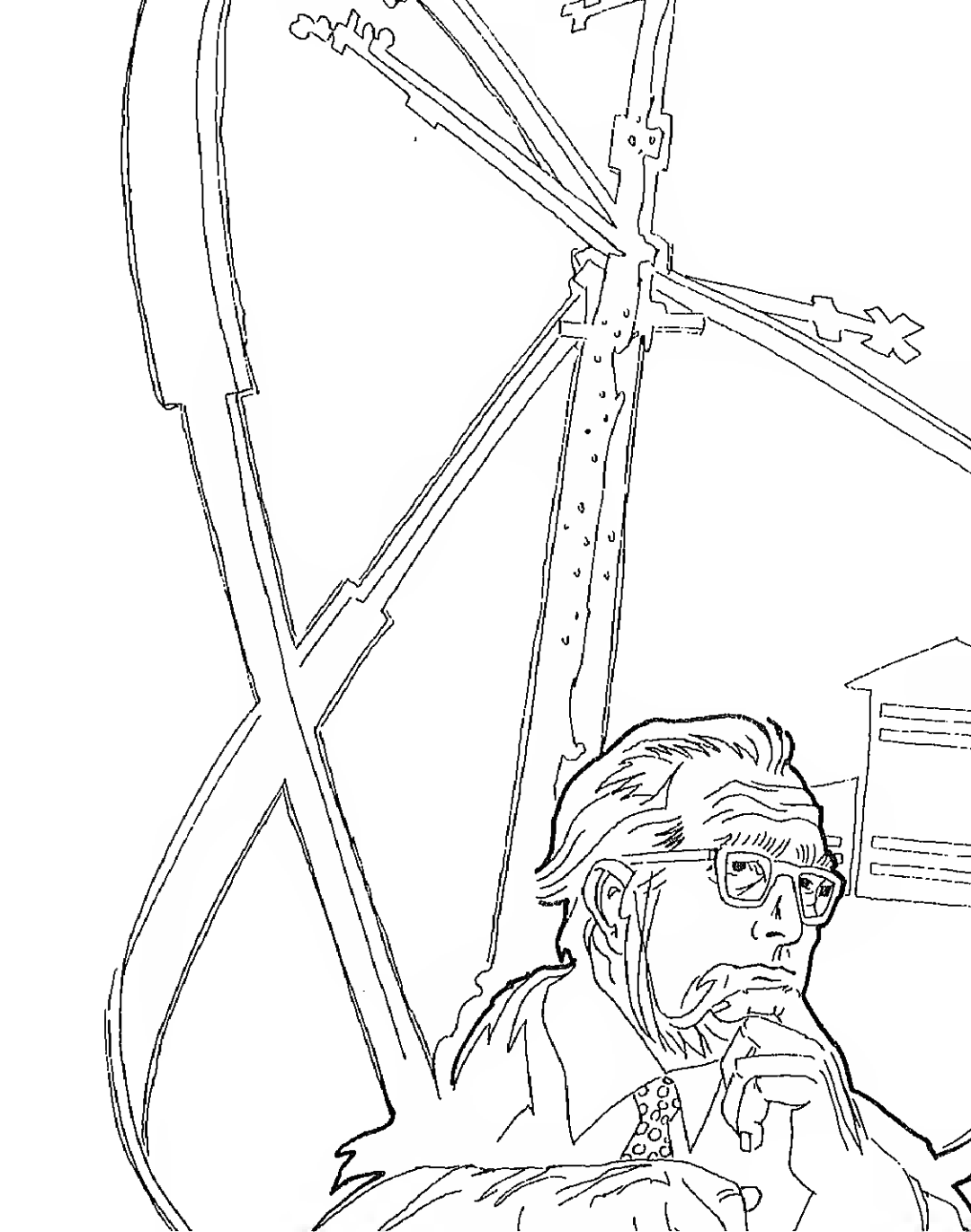
July 1979



DUCTION

This handbook is designed to help national, state, and local decisio
the following types of energy choices:

- o Whether to mandate energy conservation measures or to build an
  pipeline for importing energy into the region.

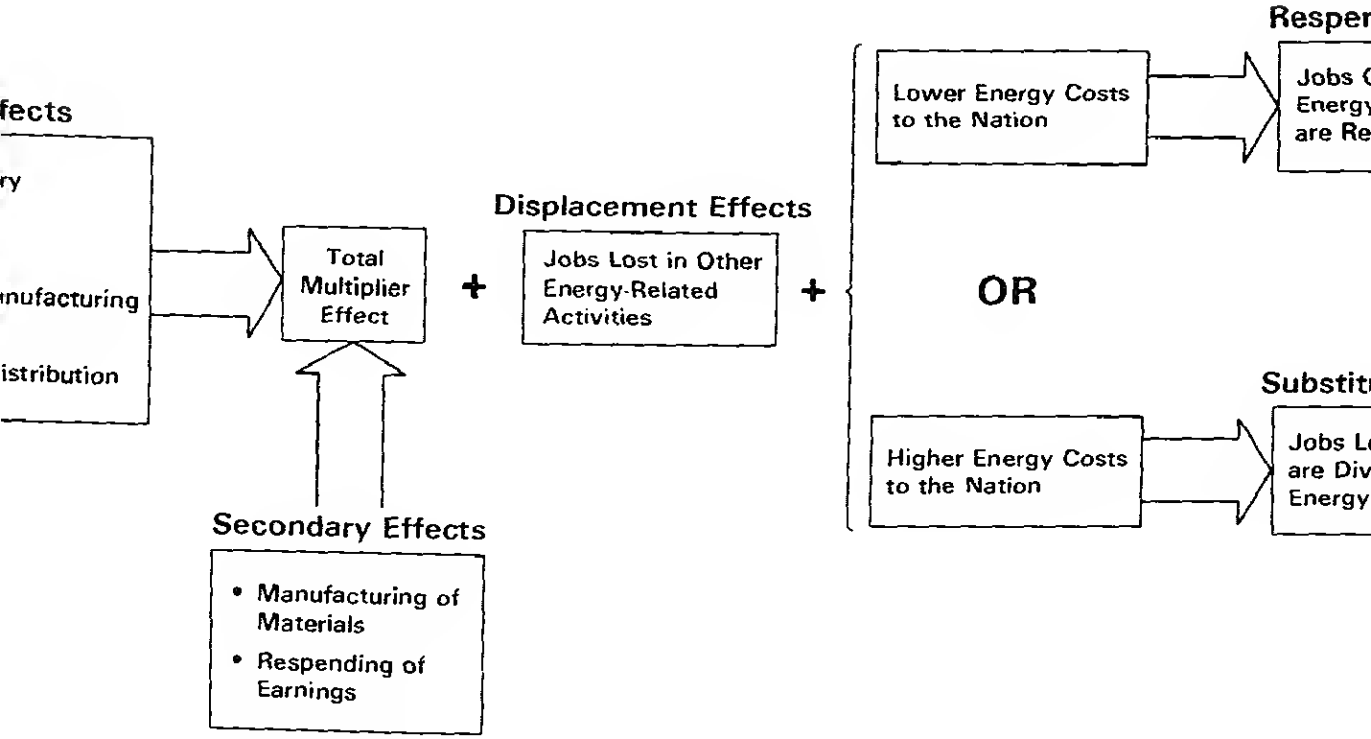
- o Whether to subsidize investment in the solar energy industry, o
  continue to rely on conventional energy sources.

- o Whether to build a wood-fired powerplant or a nuclear plant to
  electricity needs of the region.

In many of these cases, employment effects will be a factor weighe
making the choice among energy alternatives. This handbook will hel
isionmakers with that part of the energy choice. Its focus is on th
loyment effects of energy development because job creation is one of
ic issues for the national or local economy. Other important issues
the quality of growth, stability of income and the provision of publ
vices ultimately depend on the number and quality of jobs. Local go
t services depend on tax flows, which stem from income which is earn
m employment. The importance of creating and maintaining jobs dicta
it policymakers take seriously the employment effects of public deci
rticularly those as fundamental as energy policy. At the same time,
oices can serve as a policy instrument for communities that desire m
ntrol over job creation in their area. It is therefore no wonder th
the debate over energy policy has focused on the job creation poten
ergy alternatives.

Energy development in general can have several effects on employm
e overall (or "net") effect on employment will depend on the relati
ide of the following factors (see figure 1):

(1) The direct effect, or the effect on labor requirements for
recovery, direct manufacturing, construction and general op
maintenance (O&M) associated with the energy development.
example, solar energy development creates direct jobs in co
component manufacturing, installation, operation and mainte
the construction and operation of backup power. For a powe
direct employment includes the labor required for plant co
resource recovery and transportation, turbine or generator
tion and distribution.


fects
ry
nufacturing
istribution
Total Multiplier Effect
+
Displacement Effects
Jobs Lost in Other Energy-Related Activities
+
Secondary Effects
• Manufacturing of Materials
• Respending of Earnings
Lower Energy Costs to the Nation
OR
Higher Energy Costs to the Nation
Resper
Jobs
Energy
are Re
Substit
Jobs L
are Div
Energy

to meet the demand for goods and services generated by the in
earnings associated with (1) and (2).

The combination of these three effects is usually referred to as t
l multiplier effect, which estimates the effects of a change in spe
ne part of the economy on total economic activity (including employ
he region.* Most multiplier analyses (and data sources) only disti
een the direct effects and "secondary effects"--that is, they combi
rect and induced effects into a single component of the total multi
e, for the purpose of this handbook, these secondary impacts will b
rred to jointly as "indirect/induced effects."

In addition to a positive multiplier impact, the energy choice can
a negative displacement effect on employment if it reduces the lab
irements associated with an alternative energy source. For example
cy decision may be to promote nuclear energy as a replacement for c
lies. In this case, the employment and earnings associated with fa
through (3) would be reduced by the employment and earnings associa
oil extraction, conversion and distribution.

Furthermore, energy choices will have a respending/substitution ef
the energy source encouraged through policy measures incurs differ
l costs than the next best alternative. If the energy source to be
ess expensive than its alternative,** real economic growth (and her
oyment and income growth) occurs as these resource savings are resp
dditional goods and services. Conversely, an energy source that co
per energy output than its alternative, snd is made available to t

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section II, part 2 of this report for a discussion of multipliers.

r the Nation as a whole, "costs" refer to the marginal, unsubsidize
per unit of energy. For most solar systems and conservation metho
price is equivalent to cost as defined above. For most conventiona
gy technologies, however, prices are significantly lower than costs
overnment subsidies and pricing policies. As long as these subsidi
ided at the Federal level, however, it is unrealistic for local com
actor them into their energy costs. Thia is because the cost of Fe
idies is spread over the entire Nation. Hence, a particular commun
be only negligibly affected (See section II, part 4).

...can decrease overall employment and earnings by divert... other (more labor-intensive) sectors of the economy.

Finally, the net employment effect of a policy choice wil... on the way the energy investment is financed. Finance refers ... of funds used to pay for an energy system, including public gra... tax credits, private expenditures combined with public funds, o... funds alone (as in the case where a technology is mandated by l... energy investment is financed through increased private spendin... be diverted from other types of expenditures in or outside of t... This will offset some of the positive factors described above.

It is more likely, however, that public funds will be used ... investment, either in the form of direct procurement or financi... to the private sector.* They will also divert spending from oth... of the economy, to the extent that public funds displace private... magnitude of this displacement depends on the method used to fin... expenditures and prevailing businesscycle conditions. There wil... one-for-one displacement of public for private funds if the publ... tures sre financed through taxation. If, on the other hand, pub... tures are financed through debt, displacement will be greater wh... markets are "tight" (e.g., during a recession) than when the eco... financial markets are experiencing expansion.

Unfortunately, the analytical work in the area of energy and ... limited.** Most of it to date examines only the direct employmen... associated with new energy technologies, in particular solar ener... vation, as compared to conventional alternatives. These studies ... for the same amount of useable energy:

- Solar hot water, heating and cooling technologies, in re... applications, can create two to eight times more direct ... conventional alternatives. In the case of liquified natu... where most of the direct labor is created in foreign cou... solar technologies can create 50 times as many direct job...

*It is possible that the energy investment will be financed by red... public expenditures in other programs. In this case, the decision... also need to consider the employment effects of reducing these exp... However, budget reorientation is rarely used as a means to finance ... investments.

**See: The Job Creation P...

o Conservation measures (i.e., insulation, weatherstripping, stor
windows, etc.) create 26 times as many direct jobs as LNG, but
fewer direct jobs than nuclear and other conventional powerplan

However, as mentioned earlier, direct jobs represent only part of t
employment picture. In fact, the results of some recent studies i
direct employment effects can be a misleading indicator of both the
and direction of total job creation. For example, the recent Feder
tic Policy Review (DPR) of solar energy compares the direct and ind
yment effects of two accelerated national solar energy scenarios wi
employment over the 1978-2000 period.** The study examines the lab
rements of 13 different solar technologies, taking account of the j
aced in the conventional energy sector due to increased solar penet
results indicate that total employment over the period for the accel
scenarios is 3 to 10 million person-years higher than for the base
ough these results indicate that accelerated solar energy strategies
a positive effect on overall employment, the magnitude of this effe
derably smaller
those implied by analyses that examine direct effects of residen-
applications only. Furthermore, the DPR did not consider the relat
of energy under each scenario, nor did it take account of labor-sa
uction techniques that would probably be necessary to meet the level
erated demand for solar.

For cost-effective energy conservation alternatives, recent studies
eate that the total employment effects can be significantly positive
sponsored by the Department of Energy (DOE) assesses the national
effects of achieving Federal energy conservation goals pertaining t

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s is because most passive solar features are simple "add-ons" to
entional buildings, and do not require a significant increase in con
labor.

e Domestic Policy Review is an interagency task force mandated by Pr
er to examine the barriers to widespread solar use, and to develop p
ons for accelerating solar implementation. See: Domestic Policy Rev
r Energy: Final Report, Impacts Panel (Volume 1) U.S. Department of
bber 1978) TID-28835/1.

generated as net energy cost-savings are respent in the economy.

The results of this study indicate that, in meeting the mpg st net employment in 1985 will increase slightly, but significantly (i to 20 thousand person-years). For the retrofit program, net employ 1985 will increase by up to 520 thousand person-years. Another rec sponsored by DOE yields similar results for industrial cogeneratio ties.** These results illustrate that direct employment alone pain incomplete picture of the total job creation potential of conservat particularly those that are cost-effective. What most people forge these energy cost-savings will be respent in the economy and create In fact, a recent study for the Joint Economic Committee indicates respending effect can be at least as large as the direct and secon ment effects combined.***

The extent to which direct employment is a misleading indicato employment depends primarily on the size and diversity of the econo question. In the case of a small isolated township that imports mo goods and services, direct employment effects would represent almos the total employment effects experienced by the region. On the oth direct effects will grossly misstate the total employment impact fo Nation as a whole, as the studies mentioned above indicate. Most o makers are faced with energy choices for regions that fit somewhere between these two extremes. This makes the task of determining the information needed to determine employment effects much more diffi Furthermore, gathering information on the employment effects of ene choices can be costly in terms of time and resources. For many ene technologies, such as solar and conservation, detailed, industry-by information on the total employment effects is simply not available other, more conventional systems, this information may be available costly to procure and utilize for the decision in question.

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*Employment Impacts of Achieving Federal Energy Conservation Goals P-1347, Institute for Defense Analysis, Arlington, Virginia. May 1

**An Analysis of the Macroeconomic Effects of Industrial Cogenerati Development. JRB Associates, Inc., McLean, Virginia (September 197

***Employment Impact of the Solar Transition. Prepared for the Joi Committee, U.S. Congress, by Len Rodberg (April 6, 1979, U.S. Gover Printing Office).

The purpose of this handbook is to help policy decisionmakers ev
nergy alternatives in terms of their employment potential. The deci
ay be a Government official on the national, state or local level; s
ay be a member of a community planning council, a community developm
orporation, or member of a non-profit research group. This handbook
esigned to provide members of these groups with:

- o A working understanding of basic economic concepts and analy
  methods that can be used to estimate the employment effects
  choices;

- o A general framework for determining how much information on
  effects is relevant for the particular policy issue and the
  economy in question; and

- o Detailed references for where the information is available a
  costs.

Serious study of this compendium may eliminate some of the need
onsultants. Much of the information provided here can be utilized w
ploying professional economists. Some information, however, requir
e of more sophisticated modeling techniques that should be contract
professionals. At the very least, this handbook will help the dec
aker evaluate the analytical work of consultants in the area of ener
nployment.

The handbook is organized into two sections, with attached appen
ection I presents a general conceptual framework for evaluating the
nt effects of energy choices. It describes the various types of em
ffects associated with energy development, and what factors affect t
de of these effects. It also provides a methodology for determinin
mount and type of information needed to assess the total employment
particular region.

Section II first provides a general description of how to use th
ndbook. It then presents a detailed listing of sources of informat
rect employment effects (part 1), indirect/induced effects (part 2)
nt effects (part 3), respending/substitution effects (part 4) and f
ffects (part 5). The availability and cost of this information is a
ncluded. Each section is designed to provide the user with a workin
anding of how these informational sources can be applied. Detailed
r further reading are also presented.

t may be an implicit choice, such as a decision to continue supportive
e.g., tax incentives) to conventional energy sources. In either case,
ecisions will effect expenditure patterns in such a way that the deman
articular energy source increases. This, in turn, will alter the leve
mployment and earnings in the economy.

In order to accurately assess the overall effect of an energy choi
mployment and earnings, decisionmakers will need information on the ma
f the direct, secondary, displacement, respending/substitution, and fi
ffects discussed in the introduction to this handbook. But the amount
nformation needed will vary, depending on two major factors:

(1) The policy question to be addressed; and
(2) The degree of economic diversification in the region.*

The Policy Question. The amount of information needed will vary,
whether the policy question is:

(1) What is the total net employment/earnings impact of a policy
to encourage energy technology A? The answer to this questio
in the form of absolute amounts, i.e., the policy will yield
of income and Y jobs in the economy. For example, a policyma
state energy office might need to determine the employment ef
introducing a sizeable tax credit for solar energy developmen

(2) In terms of net economic impact, how does a policy decision t
encourage technology A compare to one to encourage technology
The answer to this question will be in the form of comparativ
amounts, i.e., the policy to encourage technology A will crea
(or less) jobs than a policy to encourage technology B. For
a Community Development Corporation (CDC) might face a choice
investing in solar energy companies or firms that provide ene

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For purposes of this report, the geographic area included within a reg
roadly defined as an economic unit--an area with economic relationship
nterdependencies among industries. A region may refer to a small rura
ity and its service area, a large densely populated metropolitan area,
he far extreme, a massive region encompassing several states.

e effects described above. However, significantly less informati
eeded for the second question. In particular, it is usually unnec
fy the displacement effect when comparing energy alternatives that
per energy output. This is because, in most cases, the energy alt
be displacing the same energy source (in which case the decreases
uirements and earnings "cancel each other out"). Furthermore, in
energy alternatives that cost the same per energy output it is
ry to quantify the "financing effect," as long as the financing me
r for both investments.

lly, in comparing energy alternatives with unequal costs, it will
ary to quantify the respending/substitution effect in the case whe
native with the greater employment effect is also the most costly.
ation it becomes unclear which alternative yields the greatest net
unless the respending/ substitution effect is also measured.

example, suppose energy technology A creates 100 jobs per unit of
hile technology B creates only 50 jobs per unit. On the basis of
n alone, a decisionmaker would conclude that energy technology A s
ed--because it creates twice as many jobs in the economy than tech
r unit of energy.

ver, let us also assume that technology A costs $100 per unit of e
while technology B provides energy at $50 per unit. Furthermore,
at a dollar of personal disposable income spent in the economy cre
Promoting energy technology A would cost consumers $50 more per
than technology B--which represents 75 jobs that would otherwise
. Taking this "substitution effect" into account makes technology
attractive. In fact, technology B creates twice as many jobs per
as technology A when the substitution effects are included.

Degree of Economic Diversification. The amount of information nee
g energy policy choices also depends on the degree of economic

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y, the decisionmaker will need information on all of the effects v
adeoffs across different policy areas, where the investments are
es for each other (except in a budgetary sense).

rs outside the region. Similarly, the local economy buys (or imports)
er portion of its goods and services from outside the region. The gre
proportion of exports and imports, the more undiversified (open) the e

Relatively limited information is needed for an economy where most of
rials for energy systems are imported, and most of the personal income
al is spent outside of the area. For this "highly undiversified" are
of the indirect, induced and respending (or substitution) effects wou
orted." Furthermore, financing for the energy investment in a small,
versified economy, will generally originate from outside the region (w
exception of direct local taxation). Hence, a decisionmaker attemptin
are two energy systems in terms of job creation in that area would, wi
degree of confidence, base the comparison on direct effects only.

In contrast, for a well-diversified economy, direct employment effect
e are a misleading indicator of the total net employment impact. An
ysis based on direct economic effects discussed above would fail to ca
significant secondary effects discussed above, and could lead to very
eading policy conclusions.

Tables 1 and 2 present a summary of the amount of information needed
ng energy policy choices, depending on the policy question asked and t
ee of economic diversification in the region. As the tables indicate,
racy of direct employment effects as an indicator for total net employ
cts within the region will be greatest when:

(1) The economy in question is small and highly undiversified.

(2) The energy choices have equal costs per energy output.

(3) The policy question requires a comparative analysis of net emplo
impacts among energy alternatives.

rnatively, the accuracy of direct effects as an indicator of total eff
be lowest when:

(1) The economy in question is large and highly diversified.

(2) The energy choices have unequal costs per energy output.

of a "small, highly undiversified" and a "large, highly diversifie
Unless the region in question is a very isolated township or, in
extreme, the Nation as a whole, the decisionmaker is still left wi
of determining how much information is needed for an accurate
nt of employment effects. This requires a more detailed look at th
ship between economic diversification and the components of the tot
r effect. Specifically, it is necessary to determine, for economi
ying degrees of diversification, the proportion of the total multip
hat is captured by the direct effect only.* If this proportion is
ntly large (i.e., within the desired range of accuracy), the decisi
n save considerable amounts of time and financial resources by focu
ysis on direct effects only. If the proportion of direct component
ltiplier is lower than the desired degree of accuracy, the decision
l to devote the resources to estimate the indirect/induced effects
the direct.

order to provide this information, individual regions must be "rank
e of economic diversification and grouped into generic economies.
eneric economies enables the decisionmaker to draw conclusions abou
own region, without the need for collecting and analyzing data spec
egion. This can save considerable amounts of time and resources.
awback, however, is that predictions based on "reference" or "gener
more uncertain than those based on region-specific data.

means of achieving a ranking of economic diversification is to sim
e number of distinct industrial sectors in each region assigned to
group. It follows that the larger the number of distinct industria
the more diversified is the region. However, this procedure is
y time consuming. Furthermore, disclosure problems at all levels o
al detail would tend to make this an inconsistent exercise at best.

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ning the informational needs for the other factors (i.e., displacem
g and respending/substitution effects) is relatively straightforwar
al, the displacement effect requires estimation only for impact ana
ows the same procedure as the multiplier effects, except that an al
rgy source is examined. In most cases the financing effect will re
on, which can be done at fairly low cost (see section II, part 4).
rule of thumb, the respending effect should be estimated whenever t
noices have unequal costs. The exception to this rule is when a
ve analysis is required and only direct effects need estimation
desired degree of accuracy.

TABLE 1

Question (1) Comparison of Net Employment Impacts among Energy Alternatives

A. Equal Costs per Energy Output

| Type of Economy | Types of Information | | | |
|---|---|---|---|---|
| | Direct | Indirect/Induced | Displacement | Respendin Substituti |
| Large (diversified) | X | X | | |
| Small (undiversified) | X | | | |
| | | B. Unequal Costs per Energy Output | | |
| Large (diversified) | X | X | | X |
| Small (undiversified) | X | | | |

*Only if methods are different for each investment.

**Only if direct taxation is used for one investment and not for the other.

TABLE 2

Question (2) Total Net Employment Impact of Energy Investment

A. Equal Costs per Energy Output

| Type of Economy | Types of Information | | | |
|---|---|---|---|---|
| | Direct | Indirect/Induced | Displacement | Respending/ Substitution |
| Large (diversified) | X | X | X | |
| Small (undiversified) | X | | ** | |
| B. Unequal Costs per Energy Output | | | | |
| Large (diversified) | X | X | X | X |
| Small (undiversified) | X | | ** | X |

*Only if direct taxation is used for the investment.

**Only if direct employment for displaced system is provided locally.

similar. This can be accomplished by first assigning economies to non-SMSA groups to distinguish between urban and rural economies.** SMSA group can be subdivided into large and small SMSA's, based on population levels. All groups are then further subdivided into geo regions, which characterize their economic structure. They are fur described by their rates of growth, as suggested by Van Zele. The represented in figure 2.

Seventeen generic economies emerge from this classification sc representing a group of specific regions with similar levels of eco diverisfication (see table 3). Furthermore, each of the 173 Bureau Analysis regions (see figure 3), SMSA's, and non-SMSA regions in th States can be classified under one of these generic economies. A l regions by corresponding generic economy is presented in tables E-1 Appendix E.

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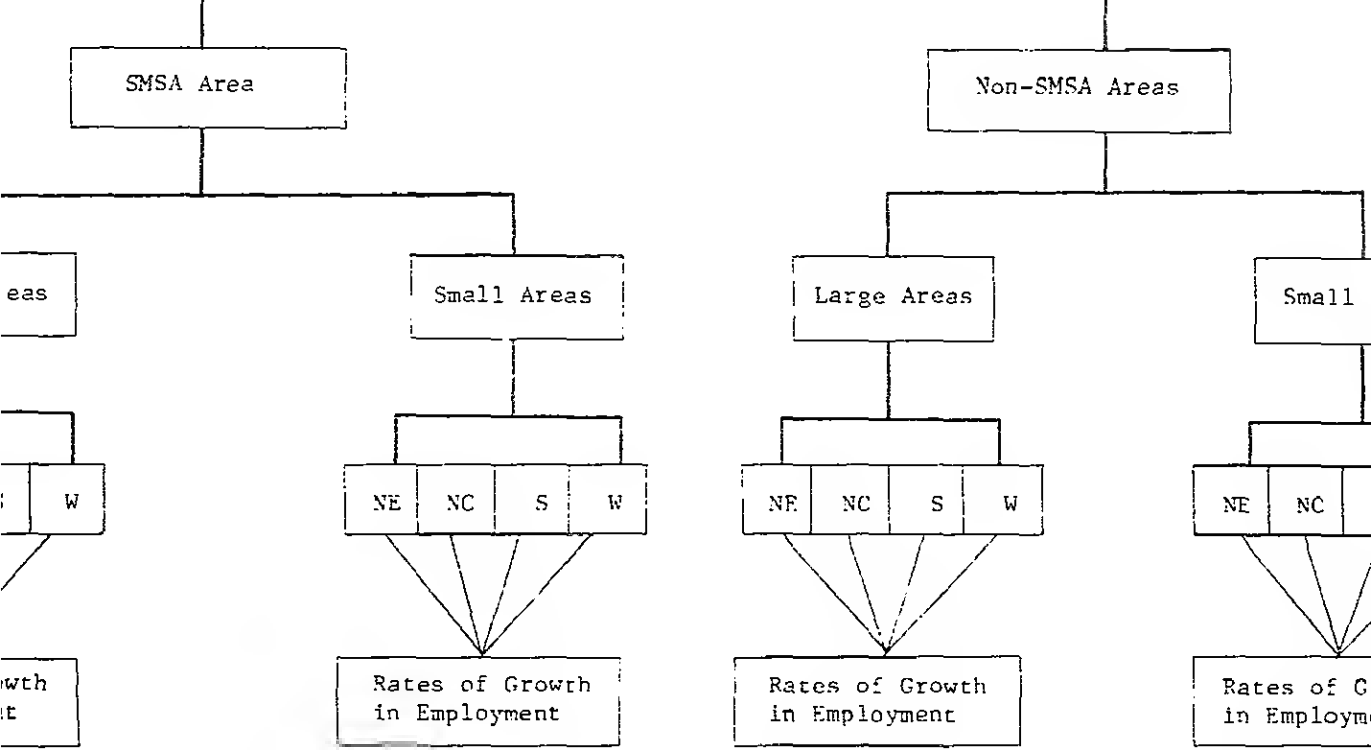
*See: "On Measuring Economic Diversification," by Merlin M. Hackba Donald A. Anderson, in: Land Economics, LI 4, November 1975, pp. 7 Concept and Measurement of Regional Industrial Diversification," by Conroy, in: Southern Economic Journal, Volume 41, No. 3, January 1 492-505; "A Portfolio Theoretical Approach to Industrial Diversific Regional Employment," by James Barth, John Kraft and Phillip Wiest, of Regional Science, Vol. 15, No. 1, 1975, pp. 9-15.

**Regional Analysis of Energy Development Impacts and Responses: S Methods, Results and Needs by Roger Van Zele (University of Pennsyl 1977).

***A Standard Metopolitan Statistical Area (SMSA) is defined as a c group of counties which contains at least one city of 50,000 inhabi more, or "twin cities" with a combined population of 50,000. Conti ties are included in an SMSA if they are socially and economically with the central city. See: Statistical Abstract of the United St U.S. Department of Commerce, Bureau of the Census, Appendix II.




2: Diagrammatic Representation of Classification Scheme for All U.S. Regional Economies

Northeast

North Central

South

| Regional Data | Growth Rate | | Centralized Conventional Energy Systems | | WECS | |
|---|---|---|---|---|---|---|
| | % | Rank | % | Rank | % | Rank |
| SMSA, Large | | | | | | |
| 1. North | 1.07 | 17 | 55.0 | 17 | 55.9 | 15 |
| 2. South | 2.11 | 8 | 60.5 | 15 | 57.9 | 14 |
| 3. West | 3.15 | 5 | 55.1 | 16 | 55.2 | 16 |
| SMSA, Small | | | | | | |
| 4. Northeast | 1.17 | 16 | 63.5 | 14 | 64.5 | 13 |
| 5. Southeast | 2.35 | 7 | 67.1 | 9 | 65.6 | 10 |
| 6. East North Central | 3.39 | 4 | 67.7 | 8 | 65.9 | 8 |
| 7. West North Central | 1.51 | 14 | 64.3 | 13 | 65.1 | 11 |
| 8. East South Central | 3.09 | 6 | 64.4 | 12 | 64.9 | 12 |
| 9. Mountain | 4.39 | 1 | 68.6 | 7 | 65.7 | 9 |
| 10. Pacific | 4.00 | 2 | 72.2 | 4 | 69.7 | 6 |

*Including photovoltaics

| Data | Growth Rate | | Centralized Conventional Energy Systems | | WECS | | Solar Collect Technol |
|---|---|---|---|---|---|---|---|
| | % | Rank | % | Rank | % | Rank | % |
| A, Large | | | | | | | |
| . | 1.98 | 9 | 65.4 | 11 | 65.6 | 10 | 65.5 |
| A, Small | | | | | | | |
| rtheast | 1.22 | 15 | 66.0 | 10 | 67.1 | 7 | 66.0 |
| utheast | 1.96 | 10 | 71.4 | 5 | 70.0 | 5 | 71.8 |
| st North ntral | 1.62 | 13 | 70.0 | 6 | 70.9 | 3 | 70.0 |
| st North ntral | 1.93 | 11 | 77.0 | 1 | 74.9 | 1 | 77.4 |
| st South ntral | 1.91 | 12 | 74.0 | 2 | 71.6 | 2 | 74.4 |
| st | 3.83 | 3 | 73.2 | 3 | 71.0 | 4 | 73.6 |
| S.A. | 2.39 | | | | | | |

ng photovoltaics.

energy conversion systems and centralized conventional energy syste
representative facilities are described in greater detail in Append
each generic economy, the proportion of direct component-to-total e
effect associated with each of these representative energy systems
eatimated. The results are presented in table 3.

As indicated in the table, the amount of information needed to
assess the employment effects of an energy choice varies significan
economies. For example, the direct employment effects of an invest
centralized conventional systems for regions classified under Gener
represent only 55 percent of the total employment effects. For Gen
15, on the other hand, direct effects account for about 80 percent
for a similar investment. Hence, a decisionmaker facing an energy
region aimilar to Generic Economy I would need to estimate direct a
induced employment effects, whereas for a region similar to Generic
15, an estimate of direct employment effect would probably be suffi

Note that the ratio of direct component-to-total multiplier do
consistantly decrease as diversification increases. This is becaus
direct-to-total ratio depends on more than just an indicater of eco
sification: It depends on the specifics of the economy's structure
requirements of the investment project. For example, consider an e
undertaken in an economy whose industrial structure is such that a
amount of direct inputs can be supplied locally, but all indirect i
locally supplied. The implication is that the economy is reasonabl
and the total local multiplier may be significant. However, the ra
component-to-total multiplier would be miniscule. Conversely, cons
situation in which few indirect requirements can be locally supplie
direct requirementa can be locally supplied. Again, the total mult
significant and the economy is fairly diverse. This time, however,
component-to-total multiplier ratio would be large. Reality, of co

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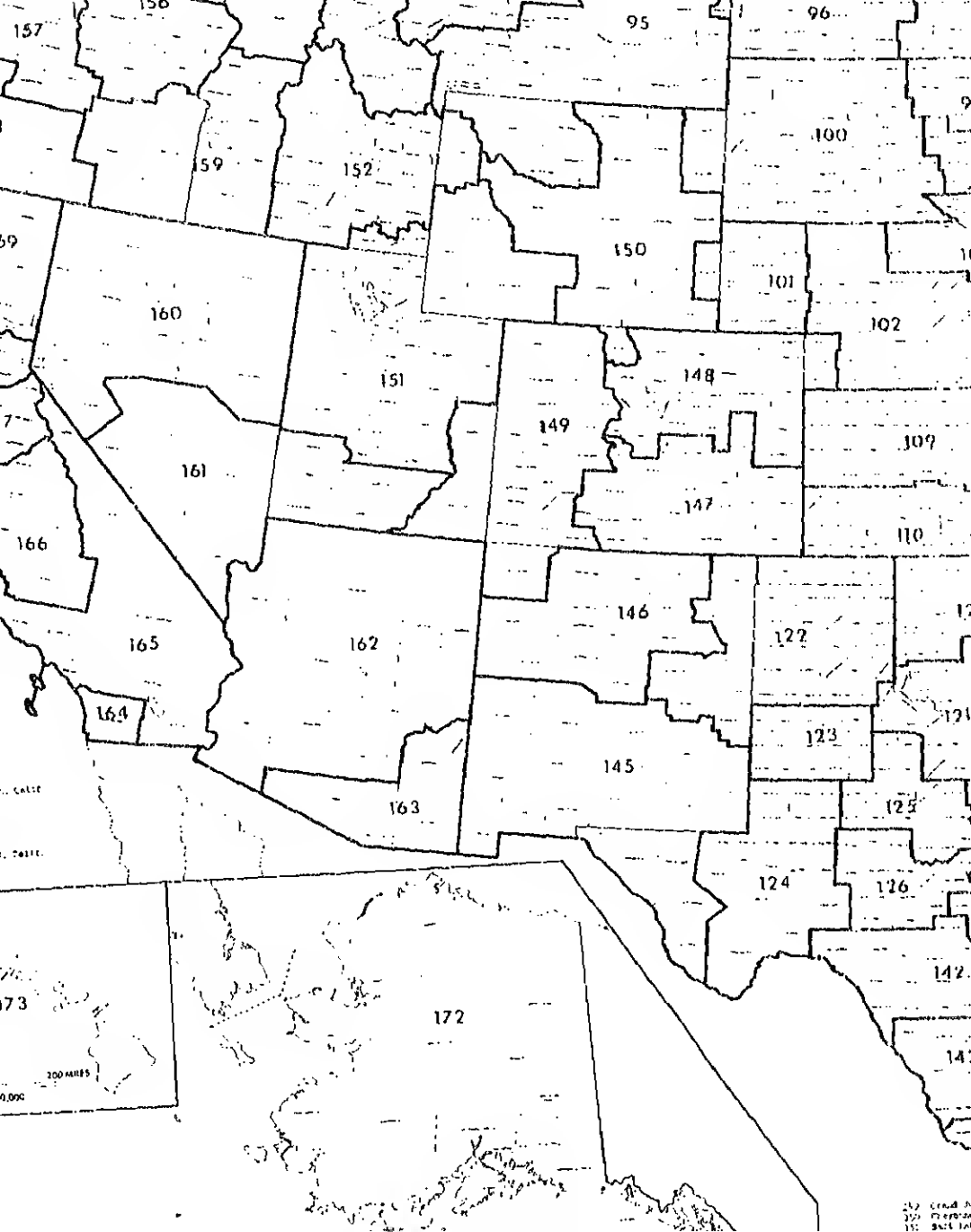
*See: A Method for Assessing the Size of Regional Multipliers and
Components, by Gregg Ferris, Solar Energy Research Institute, Golde
(DRAFT, March 1979). The Institute will be publishing a detailed m
for developing generic economies and representative energy systems
by fall 1979. A summary of the methodology used is presented in Ap

s described above, table 3 is designed to aid decisionmakers in
ining their informational needs for assessing the employment effec
choicea. However, important qualifications must be attached to t
s data. Several notions of "generic" or "reference" cases have be
Whenever reference data are used, potential users of those data m
d that the data probably do not describe nonreference experiences
imitation alao applies to any use of this table for regions larger
r than those specified in table 3. Users of this information are
autioned to consider the realities of the situation and apply the
eport judiciously. Despite these limitations, the data in table 3
rovide a reasonably accurate guide to informational needs. For th
s mentioned above, the table is not designed to be used in estimat
te level of the employment multiplier or its components. These es
should be based on data sources that are as specific as possible t
economy. The purpose of section II is to provide the user with re
formation of this type.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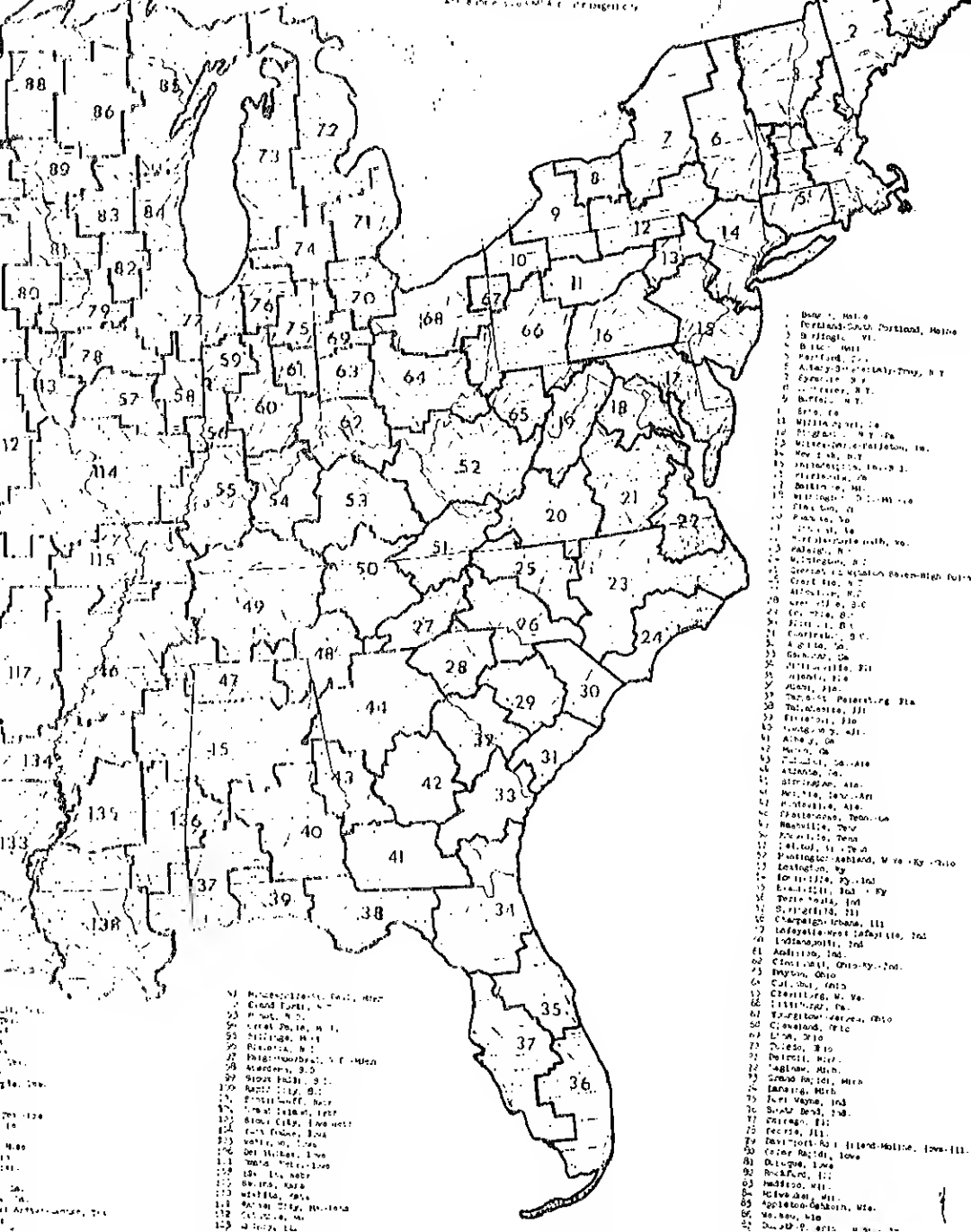

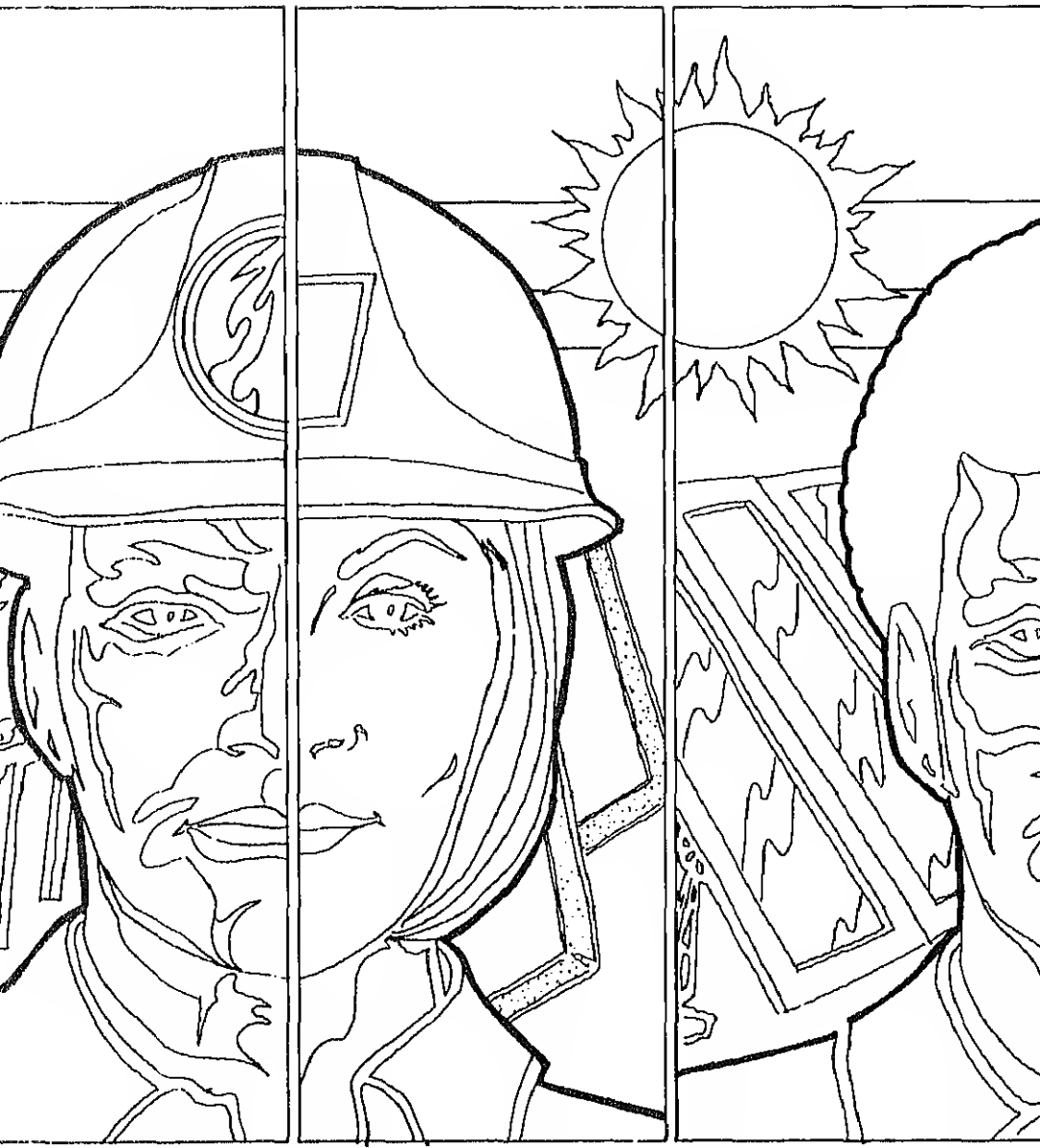

attain the highest degree of confidence in an analysis of ener
reality, however, there are cost, time and availability constr
the ability of decisionmakers to obtain all the information ne
cated in table 3, the cost of making energy choices on the bas
information is reduced confidence in the outcome. However, th
minimized if scarce resources are devoted to obtaining informa
employment effects most relevant for the economy in question.
section I was to assist decisionmakers in assessing which type
are most relevant for energy policy choices.

In addition, the "uncertainty" aasociated with energy cho
reduced as more detailed information on the relevant employmen
available to decisionmakers. Unfortunately, there is almost a
ship between the level of detail and the level of costs, so th
constraints are a major limiting factor. Sources of informati
employment effecta of energy choices range from individuals wh
data on the labor intensity of various energy technologies to
systema that are available at relatively high cost. The purpo
is to present a list of relevant references for this type of i
starting with the simplist, least-costly sources to the most c
expensive (see table 4). On the basis of section I, the decis
decide which types of information are the most relevant for hi
Then, using the references presented below, the decisionmaker
exactly where the information is available and at what coat.
are six major steps to follow in using this compendium:

- o Step 1: Determine the level of economic diversificati
  in question. Thia can be done using tables E-1 and E-
  and table 3 above, which allocate specific regions to

- o Step 2: Determine how much of the total employment ef
  by the direct component alone. This can be done using
  presents the direct component-to-total multiplier for
  Economy.

- o Step 3: Decide whether the degree of accuracy implied
  component-to-total is sufficient for the task. If it

employment effects are within the budget. This can also be done using table 4.

- Step 6: Determine whether the displacement, financing and respen substitution effects require estimation. This can be done using 1 and 2. Informational sources on these types of effects are pre in section II, parts 3, 4 and 5.

A specific example will help to illustrate how this handbook can be ionmakers on the national, state or local level: Suppose that a Com opment Corporation (CDC) in the El Paso, Texas SMSA area wants to as cal employment impact of investing in solar collector manufacturing nies. Assume that the financing for this investment will originate al grant, and that the budget for the employment impact study is $20

Following the steps outlined above, the CDC decisionmaker should fir to table E-1 in Appendix E and table 3. From table E-1, she/he lea the economy of El Paso SMSA is approximated by Generic Economy 16. ding to table 3, direct effects alone will account for about 75 perc otal employment effects. The decisionmaker decides that this level cy is sufficient for the task.

Informational sources for direct employment, and their costs, are pr rt 1 of this section. Table 4 lists these sources by increasing cos s the reader to the sections in part 1 that describe each source in 1. In this example, the decisionmaker could use the following sourc te the number and types of jobs associated with solar energy develo

- Individuals with access to labor-intensity coefficients;
- Summaries of institutional studies, industry estimates and survey
- Detailed Characteristics volumes from the 1970 Census;*
- Data tapes for the Brookhaven National Laboratory Input-Ouput Model, and the Regional Industrial Multiplier System;

---

example, this particular source can be useful in determining the typ associated with manufacturing of solar components and collectors, as the labor requirements are similar to those in most types of manufac

- The Bureau of Economic Analysis Regional Economic Informat (REIS);

- The Bureau of Census "County Business Patterns";

- The Bureau of Labor Statistics (BLS) data tapes.

The other sources listed in table 4 either cost more than the will permit, or else do not contain information applicable to dece solar technologies.

Since some of the data sources mentioned above contain nation only, the decisionmaker should also contact the local Employment S and Local Buildings and Trades Council to make sure that the skill required are available locally. In addition, the decisionmaker mi compare the employment effects of solar energy development to a "b tion, using REIS projections of employment and earnings for the ar

The next step is to determine how much information is needed the displacement, financing and respending/substitution effects. section I, indicates that information on the displacement effects only if the direct employment for any displaced energy is provided To get a better handle on the displacement effect, the decisionma look at any of the regional information sources (within the budget table 4. In particular, the Bureau of Census County Business Patt be useful in determining the size of local area employment in exis sectors. A call to the Local Buildings and Trade Council would al (and free of charge).

Table 2 also indicates that the financing effect does not req estimation for this example. This is because funds for the energy will originate outside the local area, i.e., from the Federal Gove However, the respending/substitution effect does require estimatio provides energy at a different cost per unit than existing energy 4 of this section can be used to evaluate the respending/ substitu

The example described above is specific to community-level en choices. Choices that are made for larger regions--or the nation a whole--would require different amounts of information. To use the component proportions in table 3 for regions that contain both SMS

$$_j = \sum_{i=1}^{n} \frac{DCP_i \cdot E_i}{E_o}$$

re $DCP_j$ = the direct component proportion of a region, j, composed of more than one generic economy

= the direct component proportion of generic economy i (e.g., i = SMSA - Large)

= the level of employment in all the generic economies of type i in the aggregated region

= the number of the generic economies

= the level of employment in the aggregated region

er organizations may be able to afford larger budgets for employment analyses than the CDC in the example above. In this case, the nmaker will examine additional, "higher cost" informational sources ose used above. However, the general steps to follow in using this will apply in all cases.

rt 1. Direct Employment/Earnings Effects. The following sources vide information on the direct employment/earnings effects of energy

Individuals with access to labor-intensity co-efficients. The most approach to determining direct labor requirements for energy systems se natioaal estimates of person-hours/mmBtu/year or person-hours/$ ent for the particular energy technology. Several people in the Government and private sector have worked with studies that assess atios for conventional as well as solar/conservation systems. These

Meg Schachter
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Forrestal Building
Room 6E-068
1000 Independence Avenue SW.
Washington, D.C. 20585
202/252-6433

TABLE 4: SOURCES AND COSTS OF DIRECT AND INDIRECT/INDUCED EMPLOYMENT INFORMATION

o National Information
• Regional (Sub-national) Information

| Source of Information | Sponsoring Organization | Cost of Information |
|---|---|---|
| •o Individuals with Access to Information | -- | free |
| •o Institutional Studies, Industry Estimates | -- | free |
| • Local Building and Trade Councils | AFL-CIO | free |
| • Social and Economic Assessment Model (SEAM) | Argonne National Laboratory | free |
| o Brookhaven National Laboratory Laboratory Input - Output Model (BNL/I-O) | Brookhaven National Laboratory | free |
| • Regional Industrial Multiplier System (RIMS) | Bureau of Economic Analysis (Bea), U.S. Department of Commerce | free |
| • North Dakota Regional Environmental Assessment Program (REAP) | North Dakota REAP | free |
| o Solar Energy Research Institute (SERI) Data Base | SERI | NA |
| • Environmental Impact Statements | Atomic Industrial Forum, Inc. | $ .25 per page |
| o Energy Supply Planning Model Data Base | Bechtel National, Inc. | $ 5 - $ 75 |

o National Information
• Regional (Sub-national) Information

| Source of Information | Sponsoring Organization | Cost of Information |
|---|---|---|
| o Bureau of Labor Statistics Input - Output Model (BLS/I-O) | Bureau of Labor Statistics (BLS), U.S. Department of Labor | $ 65 - $100[a] |
| •o D.S. Department of Labor Construction Manpower Demand System | U.S. Department of Labor | 76 - 300 |
| •o BLS Data Bank Files | BLS, U.S. Department of Labor | 0 - 285[a] |
| • "County Business Patterns" and "Detailed Characteristics" Volumes from 1970 Census | Bureau of Census, U.S. Department of Commerce | 10 - 320 |
| • SEAM | Argonne National Laboratory | [b] |
| • Arizona Economic Demographic Projection Model (EDPM) | Office of Planning, Arizona | 50 - 75 |
| o BLS/I-O | BLS, U.S. Department of Labor | 100[a] |
| • Utah Process Economic and Demographic Impact Model (UPED) | Office of State Planning Coordinator, Utah | 150 |
| o Brookhaven I-O/BESOM System | Brookhaven National Laboratory | 100 - 300[b/c] |
| • RIMS | BEA, U.S. Department of Commerce | Up to $1,000 |
| • Bureau of Reclamation Economic Assessment Model (BREAM) | Bureau of Reclamation, Denver, Colorado | 680 - 800[b] |

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es only.
edure for the use of this model has not yet been established.
time only; data is free of charge.

TABLE 4 (continued): SOURCES AND COSTS OF DIRECT AND INDIRECT/INDUCED EMPLOYMENT INFORMATION

o National Information
• Regional (Sub-national) Information

| ployment | Source of Information | Sponsoring Organization | Cost of Informatic |
|---|---|---|---|
| ct/Induced nued) | • State Survey - Based Input - Output Model | State Energy Offices, Universities, Utilities | $ 100 - $1,000[d] |
| | • Regional Science Research Institute Model (RSRI) | Regional Science Research Institute | 500 - 1,350[d] |
| | o INFORUM Model | University of Maryland | 5,000 |
| | • Energy Systems Research Group Model (ESRG) | Energy Systems Research Group | 6,000 + |
| | • REAP | North Dakota REAP | $30,500 for ada to other region |
| | •o Lawrence Berkeley Laboratory Model | Lawrence Berkeley Laboratory | Up to $100,000 |

1536 Cole Boulevard
Golden, Colorado 80401
303/231-1053

Erick Stenehjim
Argonne National Laboratories
9700 S. Cass Avenue
Argonne, Illinois 60439
312/972-2000 ext. 3754

Leonard Rodberg
515 N. 110 Street
Apt. 7G
New York, New York 10025
202/483-3321 or 212/662-2463

Robert A. Herendeen
Energy Research Group
333 Advanced Computation Bldg.
Urbana, Illinois 61801
217/333-7168

William F. Hahn, Coordinator
Construction Labor Demand System
U.S. Department of Labor, Room N-2423
200 Constitution Avenue, NW.
Washington, D.C. 20210

William R. Schriver
Project Manager
Forecasting and Analysis Office
Tennessee Valley Authority
327 Miller's Building
Knoxville, Tennessee 37902
615/632-3714

Paul Paskert (415/768-5775), or
Michael Gallagher (415/768-7949)
Bechtel National Inc.
P.O. Box 3965
San Francisco, California 94119

B. Summaries of institutional studies, industry estimates and su
veral recent studies have compiled data on the direct labor requireme

On the basis of institutional studies, industry estimates, environment statements and reports, the number of employees required for manufactu construction, operation and system design were determined. The reault these studies are presented in tables A-1 through A-20 (appendix A). makers can select pertinent information from these tables and make add to this data when other, more specific information is available.

C. Local building and trade councils are sources for free inform on the availability of local labor for over 15 construction crafts. Mo councils can also provide information on the skills needed for a partic energy project, on the basis of past experience. There are 450-480 cou throughout the country. Phone numbers are available through the Buildi Construction Trades Department, AFL-CIO (815 16th Street, NW., Washingt D.C.; phone: 202/347-1461; Contact: Guy Roth).

D. Environmental Impact Statements (EIS) are a good, inexpensive for information on the employment effects of energy projects. The Atom ndustrial Forum, Inc. (INFORUM) maintains an extensive library and bib f EIS's (and Environmental Reports) for fossil fuel and nuclear powerp rojects and transmission lines. Most EIS's require information on the ent impacts of the energy project, although the quality of the analysis ary widely from statement to statement. The projects are classified by f the facility, but are cross-referenced by geographic region and other tegories.

st and Availability of Information:

INFORUM will provide copies of the EIS (or Environmental Reports) o bsections of the reports (e.g., the employment impact section) for $0. ge. Contact:

Elizabeth Hannon
INFORUM
Atomic Industrial Forum, Inc.
1016 16th Street, NW.
Washington, D.C.
202/833-9234

E. The Bechtel data base for the Energy Supply Planning Model (ESPM) tains detailed national average cost and employment information on 101 ected energy facilities (see tables C-1 and C-2 in appendix C). Each lity is designed in terms of an ave age size

construction costs, which include primarily labor, mate
equipment costs; (2) land costs; (3) general plant (e.g
ties shared by a vertically integrated company like the
yard of an electric utility which services a powerplant
mission lines); (4) tangible assets (e.g., licenses, pa
(5) escalation during construction--this compensates fo
able cost increases occurring during the construction p
interest during construction; and (7) working capital (
special funds). These cost estimates are in January 19
dollars and are presented in total (as opposed to annua
amounts. They are based primarily upon in-house engine
estimates by various divisions of Bechtel Corporation.
more, this data base matches material and equipment cos
by appropriate BEA sectors (see section K(2b)). Althou
costs (i.e., capital cost per unit of energy output or
not explicitly present in the data base, this informati
derived from the background documentation on each facil

- Operating and Maintenance Costs -- O&M costs for each e
facility are presented in this data base. These costs
segmented into six major categories and 25 minor catego
The former are: (1) labor; (2) materials; (3) equipmen
utilities; (5) rent; materials and equipment costs corr
directly to comparable categories under capital costs.
tion, these costs are presented in January 1978 current
The cost estimates were initially determined by Stanfor
Institute, but updated periodically by Bechtel.

- Labor Requirements -- For each facility, labor requirem
are estimated for both the construction and O&M phases.
requirements, which are presented in thousand person-ho
listed under two general groups: non-manual and manual

*This summary of the Bechtel data base was drawn from: A Review of
Bases For Energy/Employment Analysis in an Input-Output-Framework, (
Consad Research Corporation, prepared for Department of Energy (DOE)
1979). Contact: Norman Seltzer, DOE, Intergovernmental and Institu
Relations (202/252-5931). The ESPM model can also be used by the pu
although the costs may be prohibitive for local groups. For more in
contact: Dr. Phiroze Nagarvala, Bechtel National, Inc., P.O. Box 39
Francisco, Ca. 94119 (415/768-8555).

(e.g., mechanics, machinists, etc.).

- o Length of Construction Period -- The length of the period for each facility is included in this data presented in both number of years and the proporti tion activity which will be completed during each

- o Materials Requirements -- About 49 selected materi items, which are used in the construction of each contained in the data base. The quality of materi during the operating phase of each facility are no the data base.

Technical reports on the Bechtel data base are available t National Technical Information Service (NTIS) 5285 Port Royal R Virginia 22161, at their listed prices (typically between $5 t reports of primary interest in this area are:

Escalation in the Costs of Manpower, Materials and Equipmen Energy Facilities. Bechtel Corporation, San Francisco. (O Report #PAE 3794-F.

Resource Requirements, Impacts and Potential Constraints A Various Energy Futures. Bechtel Corporation, San Francisc 1978) #PAE 3794-9.

The Bechtel data base is also available on computer tapes, obtained for about $75 and are currently being updated. Contact

Paul F. Paskert (415/768-5775)
or Michael Gallagher (415/768-7949)
Bechtel National, Inc.
Post Office Box 3965
San Francisco, California 94119

F. The Department of Labor has developed a low-cost, easil model to determine national or regional labor requirements by c related construction projects. The Construction Manpower Demand can forecast, for periods up to 10 years in the future, the cons requirements for:*

*CMDS also forecasts construction labor requirements for reside non-residential buildings, and non-building (non-energy) structu

- o Uranium Mining, Refining, Processing and Storage.
- o Petroleum Production, Refining, Processing and Transportation
- o Natural Gas Development, Processing, Production and Transport
- o Other Energy Projects and Facilities (including Hydroelectric

S provides information on monthly labor requirements over the construc iod for 29 construction crafts.

In addition, CMDS provides information on five on-site technical upations (e.g., engineering and management) two non-technical (e.g., rical) on-site occupations, and operation and maintenance (O&M) requir ts by occupation for all energy projects. The CMDS also generates the e bill over time by craft, as well as materials and equipment costs, saggregated to two-digit Standard Industrial Classification (SIC).*

The model also forecasts monthly labor demand (by craft) for all struction activity in the region. This information can be used by reg state planners to determine whether a new energy construction project se supply bottlenecks in certain craft categories. The Department of L) releases a report on total construction manpower demand for each st e or twice a year. Upon special request, the DOL can provide this inf n by Bureau of Economic Analysis (BEA) regions (see figure 3 in Sectio

The cost of a report on monthly manpower requirements (by craft) for gle Facility in a region is $76. The cost of demand forecasts for tot struction manpower is:

| | |
|---|---|
| by state | $0 |
| by BEA region | $200-$300 |

Further information, contact:

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blished employment statistics usually follow the classification scheme Standard Industrial Classification Manual, Executive Office of the sident, Bureau of the Budget (U.S. Government Printing Office, 1972). rief but excellent discussion of this classification scheme, see: Mak se Out of Dollars: Economic Analysis for Local Government (November 1 14-16). Available from the National League of Cities, 1620 Eye Stree

327 Miller's Building
Knoxville, Tennessee 37902
(615) 632-3714

G. The Solar Energy Research Institute (SERI), data base, in summer 1979, will contain detailed national cost and employme on 16 solar-related technologies (see exhibit 1). The cost esti parameters developed for this data base were based primarily on supplied to SERI by DOE national laboratories (e.g., Argonne, Lo Lawrence Berkeley Laboratories, Oak Ridge). This information in

- Capital Cost -- Estimated capital cost for 16 solar are contained in this data base. These costs are p years 1975, 1985, 1990, and 2000 and are expressed 1972 dollars per $10^{12}$ Btu output. Subsequently, ca cients are developed to coincide with those INFORUM supplied the necessary inputs for the construction facility.** The data base can be readily matched w BEA sectors, to be used for similar input-output ap

- Operating and Maintenance Costs -- O&M cost estimat for 14 of the 16 solar technologies in the SERI dat mates were not developed for the passive solar and stoves technologies. As with the capital costs, th given in millions of 1972 dollars per $10^{12}$ Btu outp disaggregated by

  INFORUM sector.* These estimates, however, assume distribution of O&M costs among input sectors remai time. Therefore, technical coefficients do not cha projected years 1975, 1985, 1990 and 2000.

- Labor Requirements -- This information will be avai SERI documentation.

*The summary provided here is based on a report by CONSAD, op. c
**INFORUM is a 200-sector input-output model, designed to produc projections over a 10 to 15-year time horizon. See part 2, sect

1. Active Solar
2. Passive Solar
3. Solar Thermal

Agricultural and Industrial Process Heating (AIPH)

4. Parabolic Dish AIPH
5. Parabolic Trough AIPH
6. Flat Plate AIPH

Photovoltaics

7. Residential Photovoltaics
8. Centralized Photovoltaics

9. Large Wind Energy System

Collection System

10. Agricultural/Forestry Residue Collection
11. Biomass Farm Production
12. Municipal Solid Waste Electric Utility

Conversion Systems

13. Manure Gasification - Anaerobic Digestion
14. Agriculture/Forestry Gasification Pyrolysis
15. Biomass Wood Stoves
16. Biomass Electric Utility System

documentation of each solar technology. As previous
SERI is expected to be publishing a background docum
data base by spring 1979. This report will specify
facility size.

- o Operating Life of the Facility -- This information i
the SERI data base.

- o Materials Requirements -- This information is not in
data base, but it will be available as part of the b
documentation.

- o Technological Change/Input Substitution -- As indica
data base provides estimates of capital coefficients
sectors for the years 1975, 1985, 1990 and 2000.* C
coefficients are projected over this period. Thus,
can be used to estimate input substitutions occuring
technology.

Availability and Cost of Information. Following approval by
Energy and publication (sometime in fall 1979), this data base wi
for public use. Cost of data is not yet determined.

Contact:

(for employment information)
Gregg Ferris: 303/231-1077
SERI
1536 Cole Boulevard
Golden, Colorado 80401

(for cost information)
Michael Yokell: 303/231-1060
SERI
1536 Cole Boulevard
Golden, Colorado 80401

*INFORUM is a 200-sector input-output model, designed to produce
projections over a 10 to 15-year time horizon. See part 2, secti

H. The U.S. Department of Commerce, Bureau of Economic Analysis, (BE ares earninga and employment data as part of its Regional Economic rmation System (REIS), available upon request. Most of this data is u t into the Regional Industrial Multiplier System (RIMS), which is desc art K of this section. The BEA can provide both historical data and ections to 2020.

Historical Data:

- Personal Income (e.g., labor and proprietors income, social insura contributions, interest, divldends, rent and transfer payments) by county, state and for the nation. Available for 37 sectors at the level (see table C-3 in appendix C ) and 16 sectors at the county level.* State data is available for selected years 1929-1958, and consecutive years 1957-1977. County data is available for selecte years 1929-1965 and consecutive years 1966-1977.

- Employment by county, state and for the Nation. Available for 37 sectors at the state level and 16 sectors at the county level. St data is available for 1967-1977; county data is available for 1967 (consecutive).

Cost of Information

Individual tables: $1 per county or state and
$1 per table with a
$5 minimum
$50 (maximum) for all counties in a state
$50 for National total
$1,000 for one table for all counties and states and the United States total.

---

se sectors are: farm, agricultural services/forestry/fisheries, minin truction, non-durable manuf., durable manuf., transportation and publi ities, wholesale trade, retail trade, finance/insurance/ real estate, ices, Government and Government services (Federal, civilian, military, local).

Mail Stop BE-55
Bureau of Economic Analyses (BEA)
Washington, D.C. 20230

The BEA alao publishes a nine-volume set of publications entitled L
ea Personal Income, 1971 to 1976, which contains estimates of total pe
come, population, per capita personal income, components of personal i
e, and labor and proprietors' income by major industries for all Unit
ates counties, the District of Columbia, SMSA's, BEA economic areas, s
l the Nation. These volumes are available from:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Cost of Information.

The price for the nine-volume set is $75; the Accession number is P
163-SET. Titles, Accession numbers and prices for individual volun
follow:

| | | |
|---|---|---|
| Vol. 1: | Summary, PB 291 164 | $11.00 |
| Vol. 2: | New England Region, PB 291 165 | $ 5.25 |
| Vol. 3: | Mideast Region, PB 291 166 | $ 6.50 |
| Vol. 4: | Great Lakes Region, PB 291 167 | $10.75 |
| Vol. 5: | Plains Region, PB 291 168 | $12.50 |
| Vol. 6: | Southeast Region, PB 291 169 | $16.25 |
| Vol. 7: | Southwest Region, PB 291 170 | $ 9.25 |
| Vol. 8: | Rocky Mountain Region, PB 291 171 | $ 6.50 |
| Vol. 9: | Far West Region, Including Alaska and Hawaii, PB 291 172 | $ 6.50 |

ea (see figure 3 in section 1) are available in:

1972 OBERS Projections, Volume 2: Concepts, Methodology, and Summary Data. 1974)* This document is available from the United States Government Printing Office, Superintendent of Documents, Washington, D.C. 20402 (202/275-3050). Cost: $2.50

rnings. Projections of earnings (i.e., wages, salaries, and oprietors income, accounting for about 80 percent of Personal Income) 2000 for states by 37 industrial sectors are available from BEA. ntact:

Gene Janisch (202/523-0958)
Regional Economic Analysis Division
Mail Stop BE-61
Bureau of Economic Analysis
Washington, D.C. 20230

dition, projections of earnings for 1980, 1990, 2000, 2010, and 2020 es by 16 industrial sectors are available for the states listed below. ation can be ordered from:

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, Virginia 22161

the ordering information shown:

: Projections, Economic Activities in...

| | | |
|---|---|---|
| ia | PB 264 580 | $9.75 |
| Carolina | PB 264 581 | $5.50 |
| cky | PB 264 582 | $9.00 |
| Carolina | PB 264 583 | $7.75 |

document also include earnings and income data which has been ly updated by BEA. The sources for this updated data are listed

| | | |
|---|---|---|
| Virginia | PB 264 585 | $ |
| Mississippi | PB 264 584 | $ |
| Tennessee | PB 260 538/AS | $ |
| Florida | PB 260 537/AS | $ |
| Alabama | PB 260 536/AS | $ |
| Summary | PB 265 473/LL | $ |

Microfiche copies are $3 each.

The above employment and earnings projections were develo contractual arrangement. BEA is preparing updated projection this year. Earnings and employment will be projected in 58-i population by age and sex, and income by source. The results for states, SMSA's, BEA economic areas, and "state-pieces" of regionalizations. These projections are described in:

> The BEA Regional Projections Program: An Overview
> Kenneth P Johnson, U.S. Department of Commerce, Bur
> Analysis, Regional Economic Analysis Division, Wash
> 20230.

I. Bureau of Labor Statistics Data Files. Current data earnings by industry in state and metropolitan labor markets from two primary sources: The Current Employment Statistics operated on a cooperative basis between the Bureau of Labor S of Labor and the State Employment Security Agencies throughou the ES-202 Reporting System which provides data on employment covered by the State Unemployment Insurance laws. The BLS 79 ment, hours and earnings estimates are available only for the and 220 major metropolitan areas while the ES-202 data are av

The BLS 790 industry employment estimates are based on m employment in firms in major industries throughout each state from these employment sample surveys are inflated by appropri estimate total non-agricultural payroll employment in major i nation and for the 50 states. The industry payroll employmen nation as a whole, the individual states, and major SMSA's ar Employment and Earnings, a monthly publication of the U.S. De

In addition, the State Employment Security Agencies publish month
a on their estimates of non-farm payroll employment for both the st
le and for selected major metropolitan areas throughout the state.
t data for the manufacturing sector are generally broken down by tw
ndard Industrial Classification (SIC) codes since the sample size f
ufacturing sector in the survey is large enough to justify such dis
. Payroll employment estimates for the remaining sectors are prov
highly aggregated form due to sample size limitations.

Sources of this type are described in greater detail in:

A Manual For CETA Prime Sponsors
Second Addition, December 1976
National Civil Service League
5530 Wisconsin Avenue
Washington, D.C. 20015
(202) 654-8864
Cost: $45 per copy

Economic/Demographic Assessment Manual
J. A. Chalmers and E. J. Anderson
November 1977. Copies are available,
free of charge from:

Bureau of Reclamation
Engineering and Research Center
Denver Federal Center
Post Office Box 25007
Denver, Colorado 80025
Attention: 922 (Contact: W. W. Reedy,
Division of Planning Technical Services)

Individual data tapes with the finest level of industry and geogr
ail on employment and earnings are also available from the Bureau o
tistics (BLS). These include:

- Industry Employment, Hours and Earnings - National. For all employees, women, and production or non-supervisory workers nearly — Cost: $110

industries at various levels of aggregation. About 1,300 published monthly series are available for production workers average earnings. Hours and earnings are available for more than 350 industries. Most series begin in 1958, although some are available from 1909.

- Industry Employment, Hours, and Earnings - State and Area. For total payroll employment, over 8,800 series of monthly data are available; they cover each state and 227 major labor areas (most of which are SMSA's). About 10,000 monthly series covering workers average earnings for each state and 192 major labor areas, beginning in 1947 or later. In the largest states, up to 170 industries are reported. Some industry detail at the 4-digit SIC level is available for recent years.

  Cost: $2

- Industry Employment and Wages (Covered by Unemployment Insurance Laws). Two files are available: A historical file and a six-quarter file. The historical file contains national and state summaries of monthly employment, quarterly wages, and a number of reporting units by 1972 SIC industry. National summaries are available for 84 two-digit, 423 three-digit and 451 four-digit manufacturing industries. State summaries are available for 84 two-digit industries. These series begin in 1975.

  Cost: de upon the specific

  The six-quarter file contains state summaries, for the most recent six quarters, of monthly employment and quarterly wages. The summaries are available for 84 two-digit and 423 three-digit industries and for 1,004 four-digit industries.

S Handbook for Methods for Surveys and Studies. U.S. Department of
oor, Bureau of Labor Statistics (1976) Bulletin 1910.

Note: Chapter 3 - "Employment Hours and Earnings"

Chapter 9 - "Employment and Wages Covered by Unemployment Insurance Laws"

ntact: Carol Utter (202) 523-1146
Bureau of Labor Statistics
Office of Employment Structure and Trends
Division of Current Employment Analysis

ble 5 provides a useful conversion chart of the various data categorie
Federal sources. With this chart, researchers can convert census sur
ies to sectors corresponding to the major group divisions of the SIC a
sectors on which the BEA reports personal income, wsges and salaries,
reports employment and labor force statistics.

re must be taken, however, in comparing census employment data with da
her BEA or the state employment agencies, since each is defined
ntly. The conceptual differences among these series principally have
(1) whether employment is counted on a place-of-work or place-of-
ce basis; (2) whether employment is counted as the number of jobs or t
of employed persons; and (3) whether employment counts only non-agri-
wage and salary workers covered by unemployment insurance compensati
udes agricultural workers, proprietors and uninsured workers. The
nces among these series are explained in more detail in:

Economic/Demographic Assessment Manual
J. A. Chalmers and E. J. Anderson
Available from the
Bureau of Reclamation
Engineering and Research
Denver Federal Center
Denver, Colorado 80225
Attention 922 (pages 48-51)

The Bureau of Census, U.S. Department of Commerce, is an excellent
f information on employment and earnings. Detailed profiles of the

| | | |
|---|---|---|
| Mining | Mining | Mining |
| Manufacturing (all types) | Manufacturing | Manufactu |
| Railroads, Railway Express Service, Trucking and Warehousing Service | Transportation, Communications, and Public Utilities | Transport |
| Other Transportation, Communications | | |
| Utilities & San. Serv. | | |
| Wholesale Trade | Wholesale & Retail Trade | Wholesale |
| Food, Bakery & Dairy Stores | | Retail Tr |
| Eating & Drinking Places | | |
| General Merchandise Stores | | |
| Motor Vehicle Retailing & Service Stations | | |
| Other Retail Trade | | |
| Banking & Credit Agencies | Finance, Insurance, and Real Estate | Finance |
| Insurance, Real Estate & Other Finance | | |
| Business Repair Services | Services | Services |
| Private Households | | |
| Other Personal Services | | |
| Entertainment & Reception Services | | |
| Hospitals | | |
| Health Serv., except Hospitals | | |
| Schools & Colleges (pvt.) | | |
| Other educational & Kindred Serv. | | |
| Welfare, religious & Non-profit Membership Organizations | | |
| Legal, Engineering & Misc. Professional Serv. | | |
| Public Administration | Government: Federal, Civilian, Military, State & Local | Governmen |
| Schools & Colleges (Govt.) | | |

Source: Impact Analysis and Local Area Planning: An Input/O
A. Harvey Block, Center for Community Economic Devel
(Cambridge, Massachusetts 1977)

occupations and industries of the employed labor force are presented i
iderable detail, including the occupational composition of employment
r industries of the SMSA's, SMSA counties, central and metropolitan ci
Detailed Characteristics volumes also report on the earnings of worker
ous occupations and industries, including breakdowns of the occupation
stry earnings data for various age, sex, and race groups.*

The Bureau of Census also publishes County Business Patterns, a serie
ications produced each year since 1946 that presents
t quarter employment and payroll statistics by county and industry
each state. Information is provided on the number and type of
rting units, payroll and employment by industry classification and
ty location. These reports are available from the Superintendent of
ments, U.S. Government Printing Office, Washington, D.C. 20401.
report (there is one for each state) costs less than $10.

It should be noted that County Business Patterns includes only data f
oyment covered by social security, derived from employers' quarterly p
returns. Thus, government employees, self-employed persons, farm work
domestic service workers are excluded. In 1973, County Business Patte
oyment data accounted for about 75 percent of total United States empl
urban counties and SMSAs, the major exclusion is government employment
rnment agencies should be able to provide this supplemental informatio
icular, each state department of labor in 1977 published a directory o
lable state statistical series. This directory shows what data exist
oyment, wages, and unemployment by available level of geographic, indu
occupational detail, and the frequency of publication.

Census employment/earnings information is also available on data tape
the Bureau of Census.** The County Business Patterns data for 1974 t

---

example see: U.S. Department of Commerce, Bureau of Census, Detailed
acteristics: Massachusetts, PC(1)-D23, table 180, "Occupation of Empl
ons by Industry Group and Sex," pp. 894-833, Washington, D.C., U.S.
rnment Printing Office, October 1972. The occupation-industry data fr
Census are primary inputs into the 1976-1985 occupational forecasts f
es and SMSA's developed by about 20 State Employment Security Agencies
ughout the Nation. Other states utilize data from the Occupational
oyment Statistics survey for projection purposes.

e reports for County Business Patterns provide summary data for all SI
stries in the county with 50 or more employees. The data tapes provid
for all SIC industries.

Customer Services Branch
Data User Services Division
Bureau of Census
Washington, D.C. 20233
301/763-2400

K. Use of Regional/National Models. The direct employment ef of an energy project can also be estimated using existing regional models. There are several types of models used to estimate the emp effects associated with some change in a local or regional economy. models discussed here are export base and input-output models. The discussed in greater detail in part 2 of this section. The purpose section is to briefly describe the procedure for determining direct effects using these models, and present the sources and costs for t information.

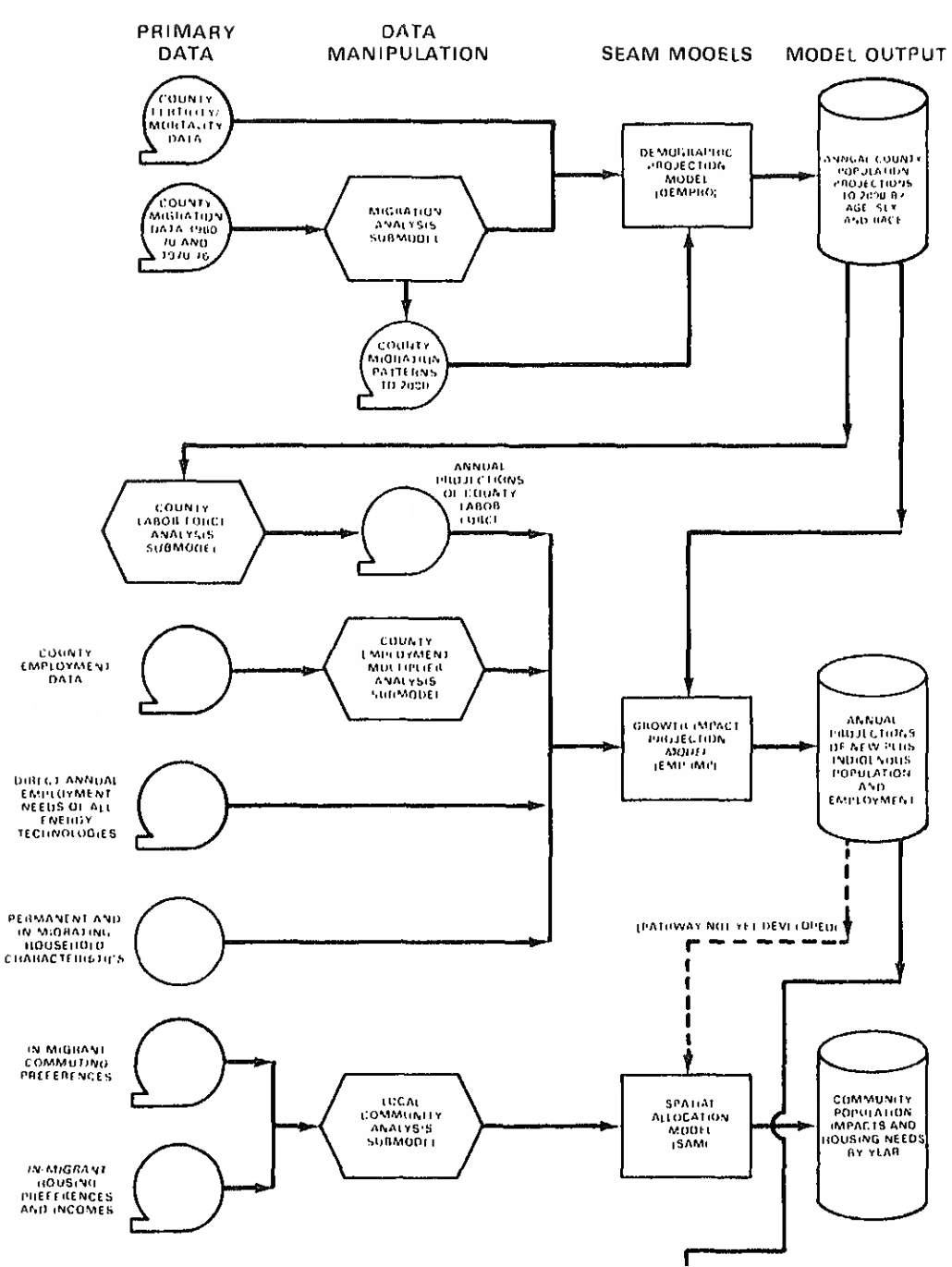
(1). Export Base Models. There is only one export base model reliable estimates of the direct employment requirements for energy directly in the data base. This is the Social and Economic Assessm (SEAM), developed by Argonne National Laboratories. A highly simpl diagram in figure 4 illustrates the four major components of SEAM, requirements, output and interrelationships.

(1a). The SEAM model first projects the annual change in the population of the subject county (or combination of counties) by ag race to the year 2000.** The user then inputs the type of technolo introduced into the county and the year in which construction will model determines the annual direct construction and operation emplo ments for that particular technology and estimates the lagged secon ment effects using employment multipliers constructed from data on cular county or counties.*** Direct employment requirements are es

*This information is in the "population file" of the Sixth Count Summary Table, 1970 Census.

**The data base includes all countries on the mainland United State the State of Virginia.

***See part 2 for discussion of these multipliers.


PRIMARY DATA
DATA MANIPULATION
SEAM MODELS
MODEL OUTPUT
COUNTY FERTILITY/ MORTALITY DATA
COUNTY MIGRATION DATA 1960 TO AND 1970 TO
MIGRATION ANALYSIS SUBMODEL
COUNTY MIGRATION PATTERNS TO 2020
DEMOGRAPHIC PROJECTION MODEL (DEMPRO)
ANNUAL COUNTY POPULATION PROJECTIONS TO 2020 BY AGE SEX AND RACE
COUNTY LABOR FORCE ANALYSIS SUBMODEL
ANNUAL PROJECTIONS OF COUNTY LABOR FORCE
COUNTY EMPLOYMENT DATA
COUNTY EMPLOYMENT MULTIPLIER ANALYSIS SUBMODEL
DIRECT ANNUAL EMPLOYMENT NEEDS OF ALL ENERGY TECHNOLOGIES
PERMANENT AND IN-MIGRATING HOUSEHOLD CHARACTERISTICS
GROWTH IMPACT PROJECTION MODEL (EMPACT)
ANNUAL PROJECTIONS OF NEW PLUS INDIGENOUS POPULATION AND EMPLOYMENT
PATHWAY NOT YET DEVELOPED
IN-MIGRANT COMMUTING PREFERENCES
IN-MIGRANT HOUSING PREFERENCES AND INCOMES
LOCAL COMMUNITY ANALYSIS SUBMODEL
SPATIAL ALLOCATION MODEL (SAM)
COMMUNITY POPULATION IMPACTS AND HOUSING NEEDS BY YEAR

1. Coal Extraction Activities (county-specific)
2. Coal-Fired Plant (Base Plant Construction and O&M only)
3. Nuclear Plant (PWR) (Base Plant Construction and O&M only)
4. Oil Plant (Base Plant Construction and O&M only)
5. Gas-Steam Plant (Base Plant Construction and O&M only)
6. Combined-Cycle Base Plant (assumed similar to coal-fired plants)

The estimates for electric power facilities are based on a joi manpower study entitled Forecasts of Cost, Duration and Manual Man-Requirements for Construction of Electric Generating Plants 1977-19 study examines annual craft requirements to construct all planned a progress electric powerplants for a range of sizes for each type of capacity. It also provides work-year schedules for the coal, oil a technologies with a capacity base size of 500 megawatts and constru of 4 years.** For nuclear facilities, a base capacity size of 800- used with a standard construction duration period of 6 years. Thes are input to the Employment Impact Projection Model (EMPIMP) compon SEAM. The EMPIMP can compute a new schedule when the specified meg size is greater (or less) than the base capacity size.

The SEAM model also computes available labor force for these e facilities by subtracting the county-specific labor work force part rates (by age, cohort and sex), from the corresponding national fig to obtain the percentage of unemployed in the local work force who sufficient jobs existed, be available to work. The model also dete household labor force characteristics of transitory workers, how ma workers and households will move into the area. This component of also permits estimations of the potential demand for residential ho of housing in the communities accessible to the facility. Finally, determines, for each year of plant construction and operation, the requirements for public services and facilities (e.g., schools, rec policy, fire) needed to accommodate the new population and the annu and operating costs of providing this infrastructure.

*Estimates are all provided for the incremental periods of 1975-1985 and 1985-1990.

**The data base for this study was based on the Construction Manpow System (CMDS) described in part 1.F.

del further assumes that in-migrants are the first to be released for workers is reduced.

imitation to this model is that it assumes zero labor competition experiencing energy development and its adjacent counties. Thus, g industrial development is explicitly included, the SEAM model at none takes place. If, in fact, industrial development is e county (or adjacent counties) for which local labor is qualified, overstate labor availability and the direct employment effects h the energy system in question.

tors limit the model to compute only rough employment trends. the SEAM model is, to date, one of the most comprehensive and ilable for analysis at the county level.

ork is presently underway to include important variables to the ill make its forecasting much more accurate and useful to the nmaker. Argonne National Laboratory is also in the process of eric solar energy systems as input into the SEAM model.

ability of Information:

t, there is no official procedure for the use of SEAM by ther than Argonne National Laboratories and the Department wever, the direct labor requirements of a particular facility can ree of charge, from the following persons:

J. Stenehjem
gy and Environmental
stems Division
nne National Laboratory
South Cass Avenue
nne, Illinois 60439
) 972-3754

Roger Shull
Ronald Matheny
ronmental Impacts Division
USDOE
'ngton, D.C. 20545
353-3311

Assumptions and Limitations," MIMEO. Erik J. Stenehjem, E
Environmental Systems Division, Argonne National Laborator

"Summary Description of SEAM: The Social and Economic Ass
technical memo ANL/IAPE/TM/78-9. Erik J. Stenehjem, Argon
Laboratories. Energy and Environmental Systems Division.

"A Framework for Projecting Employment and Population Chan
Energy Development Phase I and II," (Draft) Erik J. Steneh
Metzger. Energy and Environmental Systems Division. Augu

(2). Input-Output Models. Input-output (I-O) models pres
interindustry description of the national or regional economy.
models are based on detailed industry-by-industry survey data.
models can also be based on regional survey data, but are usual
simple "top down," non-survey adaptations of national models.*

For both types of I-O models, employment/income effects ne
"localized." That is, there needs to be a procedure for determ
of employment/income that is retained within the region, given
final demand for the output of an energy sector (or any other i

The general procedure for "localizing" direct employment a
effects in input-output models is as follows:**

(a). Determine the industry sector(s) affected by the ene
project and estimate the dollar level of final demand for each
This step involves:

---

*A "top down" approach determines regional trends or impacts by
allocating national patterns to regional and state levels. An
tive approach is to use regional data as input for a specific r
model, as in the case of survey-based state I-O models. Using
from specific and independent models to determine results for a
aggregated region is often called the "bottom-up" approach. Se
2, section (D)4 for further discussion of non-survey models.

**For a detailed description of how nuclear powerplant requirem
"localized" for the Phildelphia SMSA region, see: Regional Ecc
Nuclear Power Plants by W. Isard, T.A. Reiner snd R. Van Zele (
Available from Brookhaven National Laboratory, Upton, New York.

requires purchases from the sawmill, concrete products, rea
concrete and diesel fuel industries.* The process of break
down an energy project (or any other investment) into prima
purchases is usually referred to as developing a bill of go
the investment.

- Converting the direct output changes into final demand chan
sector. This usually involves removing wholesale or retail
and transportation margins from the sales figures and alloc
them as final demand to the trade and transportation sector

(b). Determine which industries are present in the region. In case
particular industry input is required, but not produced in the region,
ut (and industry) is deleted. In effect, this assumes that the input
orted.

(c). For the remaining industry sectors determine whether there is
fficient local production in a given supplying industry to permit local
rchase of the input. This can be done using a location quotient. Loca
otients are measures of the degree to which a region produces the indus
tput it needs. For a given industry, the location quotient ($L_i$) is the
lustry's proportion of regional total earnings or employment divided by
ne proportion for the Nation.***

$$L_i = \frac{e_i/e}{E_i/E}$$

where $e_i$ is earnings/employment in the region in industry i.

---

egional Employment and Income Effects of a 50--MW Wood-Fired Powerplant
eter VanderWerf. Theyer School of Engineering, Dartmouth College, Hanc
w Hampshire 03755 DSD #90.

See: The Use of Input-Output Analysis, Regional Development and Plan
aluation, U.S. Department of Agriculture. Agriculture Handbook No. 530
-72. Also, see: Net Energy Analysis: Handbook for Combining Process
put-Output Analyses by Clark Bullard et al. CAC Document No. 214, Cent
vanced Computation, University of Illinois (Urbana Champaign; 1976).

*Note: For national analysis, $L_i$ would be equal to one.

represents 2.5 percent of United States total earnings. For the midwe
SMSA, assume that 4 percent of earnings in the region originate in thi
According to the formula above, the location quotient is 1.61, that is
midwestern SMSA produces more food and kindred products than it needs
exports the excess. Hence, for each dollar of final demand in that in
all of it can be met by local production. The location quotient is 1.
application described below (i.e., it will never be greater than 1.0 w
in I-O analysis). If, on the otherhand, only 1.5 percent of earnings
midwestern SMSA originated from this industry, the location quotient w
only 0.60. This implies that the region can only meet 60 percent of f
demand in that industry through local production. It imports the rest

Multiplying the total change in final demand by this location quo
yields the final demand change for the region by sector:

For each sector:

| Change in Final Demand ($1,000) | x | location quotient | = | Change in Final Demand Within Region ($1,000) |
|---|---|---|---|---|

In many regional models, the change in final demand within the re
presented as a "direct effect coefficient."

$$\text{Direct effect coefficient} = \frac{\text{Change in Final Demand Within Region (\$1,000)}}{\text{Change in Final Demand (in \$1,000)}}$$

(d). The change in final demand (or the direct effect coefficien
for the region is then multiplied by the direct employment coefficient
person-years per dollar of output) for the relevant sector. This yield
change in direct regional employment (in person-years) due to a change
demand for inputs:

The direct employment effects can be translated into earnings
using the appropriate earnings/employment ratios:

ector:

| oyment | x | Earnings/Employment Ratio | = | Direct Earnings Effects |
|---|---|---|---|---|

natively, earnings associated with direct employment effects can be
using earnings/output ratios:

ector:

| Final Demand gion (from (c)) | x | Earnings/Output Ratio | = | Direct Earnings (income effects) |
|---|---|---|---|---|

nput-output models have this basic format for determining direct effects.* However, they differ in the level of industrial sector , in particular, the level of energy sector disaggregation. Below is national/regional I-O models that are available, with a description of onal and sector disaggregation, and references for further information peration and use.

The Brookhaven National Laboratory Input-Output Model (BNL/I-O) is a I-O model of the national economy, with total output employment and precasted for 1985.** The BNL/I-O model can be linked to a linear submodel of the energy sector and/or to macroeconomic models that inal aggregate demand (see part 2). The 110 sectors are listed in n appendix C. The model currently includes 8 energy end-product

---

exceptions are I-O models tied to demographic models, where the force is actually projected and "matched" to the labor requirements with a new basic industry (such as energy). See, for example, the of the REAP model, section K(2c) below.

I-O model was developed in collaboration with the Center for Advanced at the University of Illinois, Urbana, IL.

technologies. This work will be completed by late spring 1979.

Availability and Cost of Information:

- o Earnings and Employment/Output ratios for the 110 nation forecasted to 1985 are available, free of charge, from:

  Paul Groncki (516/345-2071)
  Joan Lukachinski (516/345-2249)
  Brookhaven National Laboratories
  Upton, New York 11973

- o National Industry-Occupational matrix for 110 sectors an occupations are available, free of charge, from:

  Paul Groncki/Joan Lukachinski
  (see above)

(2b). Regional Industrial Multiplier System (RIMS). The R designed to estimate regional impacts of changes in final demand of industries, and is used primarily to analyze site-specific im from energy-related activities. The model generates estimates o indirect/induced changes in output, earnings and employment for industrial sectors. As in the case of the BLS I-O (see below), technologies, conservation methods and other "unconventional" en must be broken into direct inputs and assigned to appropriate in Appendix B refers the reader to recent attempts to incorporate s and conservation measures into the I-O framework. RIMS multipli from the production relationships listed in the 1967 BEA Nationa Table. They are provided for each of the 173 BEA economic areas in section I) and have been used to derive multipliers for every nine census regions. The state and census models disaggregate n effecte into 103 industrial categories. The census model also c aggregated industries (see table C-5 in appendix C).

Availability and Cost of Information:

- o National earnings - output ratios and direct-effect coef by BEA region are available for 56 aggregated sectors in

more than 56 sectors, the cost of obtaining information on direct effe
BEA regions is the same as obtaining information on direct, indirect,
uced effects (see part 2, section D(4b)).

erences:

Selected Analytical Data for Regional Impact Analysis: Procedure Use
Guide to Application, prepared for FEA by the Regional Economic Analy
Division, BEA, U.S. Department of Commerce, September 1976.

The Economic Impact of Oil Resource Development on the Alaskan Econo
1975-85, FEA/B-76/082, prepared for FEA by the Regional Economic Ana
Division, BEA, U.S. Department of Commerce, September 1975.

Guideline 5 Regional Multipliers, Regional Economic Analysis Divisio
Bureau of Economic Analysis, U.S. Department of Commerce, January 19

For sale by the Superintendent of Documents, U.S. Government
Printing Office, Washington, D.C. 20402. Price: $2.00
Stock No. 052-045-000-48-7.

sonal Contacts:

Joseph Cartwright (202) 523-0594

Regional Economic Analysis Division
Bureau of Economic Analysis, BE-61
Department of Commerce
Washington, D.C. 20230

David Sandoval - Department of Energy
Room 6119, 12th and Pennsylvania Avenue
Washington, D.C.

(2c). The North Dakota Regional Environmental Assessment Program (R
vides baseline and energy project impact projections for a 15-county a
tern North Dakota. Outputs are available at the county and municipal
include such variables as employment by type*, population by age and

---

es of employment in this model are: construction, operation, indirec
igenous (i.e., baseline) jubs.

rsonal income also are available at the regional level). The REAP mo
ntains five basic submodels: an input-output economic model, a demog
del, an economic-demographic model interface, a residential allocatio
d a fiscal impact model.

The REAP input-output model provides baseline projections of gross
lume from which employment requirements by each of 13 sectors are der
le C-6A in appendix C). The user must select the energy projects s/
cluded in the energy development scenario to be evaluated. The model
set of 31 projects which are various possible configurations of expor
al-fired thermal electric generating plant or substitute natural gas
aracteristics. Characteristics (including direct labor requirements)
pical plant of each type are presented in tables C-6B to C-6D in appe

The REAP demographic model provides projections of population by a
x and an estimate of the available labor force. The interface compon
e projections of required employment from the input-output model with
ojections of available labor force from the demographic model to dete
vel of employment needs that can be met by the indigenous population
at must be met by the in-migration of new workers for each county and
lity. The residential allocation model estimates the settlement patt
w workers and their families and the fiscal-impact model provides pro
the changes in public sector costs and revenues resulting from the a
onomic and demographic changee. The REAP model can be used to provid
ed conclusions about energy development in the western states, but is
propriately applied to the specific, 15-county area. Other regions c
rchase the model and adapt it to their regional economic and demograp
aracteristics (see part 2, section D(6)).

st of Information:

| | |
|---|---|
| o Direct labor requirements and annual expenditures for 31 energy projects | Free of charge, Contact: Glen Schaible (see be |

ferences: (available free of charge)

The REAP Economic-Demographic Model: Background Structure and App
by F. L. Leistritz, et al., prepared for U.S. Department of Energy
Dakota Regional Environmental Assessment Program.

(February 1978).

er Handbook (and Updates). Available from Director of User
ND-REAP, 316 N. 5th Street, Suite 521, Bismarck, North Dakota

cts:

chaible
Coordinator
Environmental Assessment Program
, 316 N. Fifth Street
North Dakota 58505
3700)

e Bureau of Labor Statistics Input-Output Model (BLS/I-O) provides
ates of total output by sector and total employment by sector and
the years 1980 and 1985 for alternative assumptions.* The I-O
on the 484-sector matrix developed by the BEA, and has been
o 129 industrial sectors by the BLS.

first determines the levels of output in 129 sectors required to
lfic forecast of final aggregate demands.** Sectoral employment
n estimated, based on projected employment/output ratios for each
ectors are listed in table C-7 in appendix C, together with the
industry codes from the Standard Industrial Classification (SIC).
oyment/ output ratios used to estimate employment changes are also
e table. Note that the model includes final demand sectors for

---

lded by the BLS gives the user the option of choosing alternative
le oil and alternative scenarios regarding economic conditions
esent and 1985.

sts are usually derived from the output of a macroeconomic
tput is then used as input into the BLS I-O model. See, for
Input-Output Simulation Procedures" technical memo TM/IA/78-03,
Analysis Division, Energy Information Administration, U.S.
Energy (July 31, 1978).

Availability and Cost of Information:

- Earnings and employment/output ratios for 129 industries ar
  from BLS on data tape for 1970, 1980, 1985 and 1990. The d
  includes input/output coefficient matrices; total final dem
  components, civilian employment; and wage and salary employ
  output series by industry with additional annual data for 1
  Cost: $100.

  Individual tables on national employment and output can als
  free of charge, from:

  Charles Bowman (202) 523-9036
  Bureau of Labor Statistics
  GAO Building, Room 4860
  Washington, D.C. 20212

- National industry-occupational matrix for 260 industries an
  occupations is available on data file from BLS. For each i
  occupation cell, three data items are provided--employment
  of employment to occupational total, and ratio of employmen
  total.

  Matrices are available for 1970, 1976 and 1985 (projected).
  Industry-occupational information for national employment i
  available, free of charge, from:

  Neal Rosenthal (202) 523-1765
  Bureau of Labor Statistics
  441 G Street, NW.
  Washington, D.C. 20212

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*A joint effort by DOE and BLS is underway to develop a sectoring p
energy perspective, which would isolate energy producing industries
consuming large amounts of energy and industries consuming large am
energy per output. The Energy Disaggregated Input/Output (EDIO) mo
disaggregate the electric utilities sector into fossil fuel, nuclea
"other" sectors. The EDIO model is currently under development.

a detailed discussion of the methods and data utilized by BLS in the
tion of the entire BLS/I-O model, see:

U.S. Department of Labor, Bureau of Labor Statistics,
Office of Economic Growth, "Methods and Data Sources:
BLS Revised 1980 and 1985 Projections," unpublished
monograph, April 1977.

BLS data files, write to:

U.S. Department of Labor
Bureau of Labor Statistics
Division of Planning and
Financial Management
441 G Street, NW.
Washington, D.C. 20212

2. Indirect/Induced Employment and Earnings Effects. The simplest
costly approach for determining the secondary employment and earnings
of energy alternatives is to use the national estimates provided in
institutional studies and/or contact individuals who have worked with
pes of information (see Part 1, sections A and B above). While this
is an appropriate starting point, it may be very inaccurate in
ns where (1) an impact analysis is needed and the secondary effects for
ular region are significantly different from the national effects, or
cision between energy alternatives must be made and each has very
secondary effects on the local economy.

alternative approach is to use a form of multiplier analysis which is
to the region and energy technology in question. Multiplier analysis
s the effects of a change in spending in one part of the economy on
nomic activity in the region. For example, suppose an electric power-
to be built in region A. Some fraction of the money spent on wages,
s and equipment for building and running the plant will go to local
businesses, and some of this increased income will, in turn, be spent
ocal economy. As a result, retail merchants and other local business
l enjoy higher sales. The expanded payrolls will be spent on basic
ems such as food, clothing and housing. Hence, the original dollar
ures for the powerplant may generate two or three times as much income

total (multiplier) effects and the direct effects discuseed in part
approaches used most frequently by regional economists for this pur
export-base multipliers, using either income or employment, and inp
models.*

A. Export base multipliers: A general description. The unde
theory of export base** is that exports are the moving force that d
the total level of local economic activity. The logic goes like th
from export activity is determined mainly outside of the local econ
sales generate labor and business income which, in turn, generates
local economy. Some of this income is spent in the local economy o
of goods and services, thereby generating still more income/employm
region. In other words, if income or employment from export sales
the total income/employment will be multiplied.

Export base theory assumes all economic activity in a region t
into two sectors: the export sector produces goods and services co

---

*Econometric models, a third approach, depend less on export-base t
define employment as a multivariate function of several explanatory
whose coefficients are estimated with regression equations. This a
overcomes many of the problems associated with multipliers. Unfort
are expensive to develop and with few exceptions have not been effe
applied to energy policy choices. A recent report by the Council o
Planning Agencies estimates that Wisconsin and Arkansas have each s
$300,000 in developing an econometric model. This cost does not ev
the salary and overhead costs of State personnel involved in the ef
for purposes of this report, only the export base multipliers and i
models will be discussed in detail. For further information on eco
models, see: Econometric Analysis of Regional Systems, Norman J. G
(Academic Press, 1977). For one of the few energy applications of
model, see: Forecasting Regional Economic Activity: The Tennessee
Model, by Richard Gustely, Center for Business and Economic Researc
Business Administration, University of Tennessee, Knoxville, Tennes
1978)--Chapters III and IV.

**Export base theory is also often referred to as economic base the
The two terms are synonomous.

here are three major variations to the export base multiplier approac
nt or simple ratios, complex ratios, and regression coefficients. Us
e ratio gives a picture, at one point in time, of the relationship o
industry to non-basic, or service industry activity. The simple equa
s relationship is:

$$MV = \frac{TE}{BE}$$

MV is the multiplier value, TE is total employment and BE is basic
ment.

he underlying assumption in simple ratios is that all employment in t
ed sectors is assumed to be basic. Mining, construction, agricultur
nufacturing are usually assumed to be basic, although other assumptio
clude such sectors as transportation. This normally results in an un
ent of the real value of the multiplier by the portion of economic ac
basic sectors that is actually local service oriented. This particu
is best used for areas with large, relatively stable economies, or w
have poor input data.

he complex ratio differs from the simple ratio in the definition of b
ment. Each sector can have both a basic and non-basic employment com
h the simple and complex ratios, however, the basic/non-basic mix fo
point in time is assumed to remain the same throughout the assessmen

he regression multiplier allows estimation of individual multipliers
h basic employment category. Unlike the simple and complex ratios,
ion multipliers provide for more than just a one time period picture
ment. Regression equations can be used to measure the effects of tim
ze, construction phase and economic base changes. Due to increased
lity, these multipliers can be applied to areas which are undergoing
and/or have a small economy.

alternative to using employment is to use income directly in comput
tiplier. Use of an income multiplier has one major advantage: it m
ces for the difference in wage rates paid for various types of emplo
nately, most available income data is out of date (e.g., BEA and BLS
least a 2-year lag) and industry or business sources are reluctant t

Export base multipliers have the advantage of being relatively simp
ory, construction and use. As a result, it is relatively inexpensive
velop these multipliers: According to one estimate,* the study of a
mmunity with 25,000 employees would cost less than $5,000, a figure we
thin the range of community budgets of cities of that size. However,
several significant conceptual and technical drawbacks to the use of
ltipliers in assessing the effects of energy choices:

1. Problems in identifying basic and non-basic sectors can detract
from the accuracy of the forecasts. Several methods used impli
assume uniform national consumption and production patterns, or
all local demand is met by local production.**

2. The assumption of a constant basic/service ratio may not prove
in the long run due to import substitution that accompanies reg
growth. This is particularly relevant for an energy project, w
expressly undertaken for the purpose of substituting imported e
with local energy sources.

3. The multiplier, as an average for the basic sector as a whole,
be applicable to a particular industry or energy project. The
of a given induatry or energy project on a region will be depen
its propensity to consume locally produced intermediate product
the consumption habits of its employees.

This last restriction implies that all energy projects that fall in
cific basic sector (e.g., construction) will have the same indirect/i
ects under this method of analysis. In effect, comparisons among ene
ernatives (policy question 2) based on <u>total</u> employment/earnings effe
no more enlightening than compariaons hased on <u>direct</u> effects alone.
use of exportbase multiplier analysis is really only appropriate for
essing the total impact of a policy decision to develop a particular
rce (policy question 1).

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e <u>Community Economic Base Study</u>, C. M. Tiebout, Committee for Economi
elopment, Supplementary paper No. 16, New York, 1962.

or a discussion of these types of inaccuracies, see: <u>Econometric Ana
ional Systems</u> by Norman Glickman (Academic Press, 1977), pp. 15-17.

The following studies are written in lay language and provide conside
ail on doing an export base study, defining sources of data, and using
product:

Making Sense Out of Dollars: Economic Analysis for Local Government.
Chapter 1, by Eva C. Galambos and Arthur F. Schreiber (1978). Availa
from:

National League of Cities
1620 Eye Street, NW.
Washington, D.C. 20006

The Community Economic Base Study, by Charles M. Tiebout, New York:
Committee for Economic Development, Supplementary Paper No. 16, New Y
1962.

Socioeconomic Impacts of Western Energy Resource Development. Vol. I
(Draft January 1979). Available from:

Denver Research Institute
Industrial Economic Division
University of Denver
Denver, Colorado 80210
(Contact: Diane Hammond, 302/753-3671)

B. Input-Output Models: A General Description. Input-output analys
ed on the interrelationships of firms both as purchasers of inputs and
ducers of outputs. This approach allows for the tracing of multiplier
cts associated with new industry development in a more detailed manner
export base multipliers.

The interrelationships among industries in the I-O framework is expre
terms of a matrix, called a transactions table, which indicates dollar
n producing sectors to consuming sectors for both interindustry and fin
. In figure 5, an illustrated example of a transactions table is provi

- o Quadrant I (final demand) contains all exogenous* sectors of the m
  and is made up of household expenditures, exports, capital expendi

---

ogenous variables are those elements in the model that must be specifie
ependently. Endogenous variables are those elements in the model whose
determined by the model, i.e., the dependent variables.

| | | Agriculture | Mining | Manufacturing | Trade | Services | Finance | Household consumption | Government expenditures | Gross domestic capital formation | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Quadrant II Intermediate production and consumption | | | | | | Quadrant I Final outputs of producing sectors | | | |
| Agriculture | 1 | $x_{11}$ .... $x_{ij}$ ..... $x_{1n}$ | | | | | | $C_1$ | $G_1$ | $I_1$ | $E_1$ |
| Mining | . | . | | | | | | . | . | . | . |
| | . | . | | | | | | . | . | . | . |
| Manufacturing | . | . | | | | | | . | . | . | . |
| | . | . | | | | | | . | . | . | . |
| Trade | i | $x_{i1}$ .... $x_{ij}$ ..... $x_{in}$ | | | | | | $C_i$ | $G_i$ | $I_i$ | $E_i$ |
| | . | | | | | | | . | . | . | . |
| Services | . | | | | | | | . | . | . | . |
| | . | | | | | | | . | . | . | . |
| Finance | n | $x_{n1}$ .... $x_{nj}$ ..... $x_{nn}$ | | | | | | $C_n$ | $G_n$ | $I_n$ | $E_n$ |
| | | Quadrant III Primary inputs to production | | | | | | Quadrant IV Primary inputs to final demand | | | |
| Payments to | | | | | | | | | | | |
| Households | | $H_1$ ..... $H_j$ ..... $H_n$ | | | | | | $H_C$ | $H_G$ | $H_I$ | $H_E$ |
| Government | | $T_1$ ..... $T_j$ ..... $T_n$ | | | | | | $T_C$ | $T_G$ | $T_I$ | $T_E$ |
| Depreciation | | $D_1$ ..... $D_j$ ..... $T_n$ | | | | | | $D_C$ | $D_C$ | $D_I$ | $D_E$ |
| mports | | $M_1$ ..... $M_j$ ..... $M_n$ | | | | | | $M_C$ | $M_G$ | $M_I$ | $M_E$ |
| gross outlays | | $X_1$ | | $X_j$ | | $X_n$ | | C | C | 1 | E |

'almer, et al. "I-O Concepts" in Regional Development a
.uation, USDA Economics, Statistics and Cooperatives
Agriculture Handbook No. 530, May 1978, p. 24.

change in the level of final demand is the action which deter
multiplier estimation.

- o Quadrant II (processing sectors) contains those sectors (or i
producing goods and services for final demand. These are the
sectors of the model. All output of the processing sectors i
sold to final demand or to other processing sectors.

- o Quadrant III (payments sectors) accounts for primary and exog
inputs purchased by the processing sectors. It shows purchas
processing sectors for inputs they do not produce. Entries i
III include payments to households in the form of wages, sala
rental income, interest income, and profits; payments to gove
imports of goods and services; inventory depletion; and capit
consumption or depreciation.

- o Quadrant IV shows the direct transactions between the exogeno
primary input sectors (payments sectors) and the final demand
This includes outputs of the local economy as well as imports
directly into final use without any intermediate processing b
endogenous sectors (for example, services of household employ
labor commuting out of the area for work, intergovernment tra
direct household purchases of nonlocal goods, etc.).

The columns of the transactions represent the producing sectors.
cell element of any column in the table indicates the dollar amount o
a consuming industry makes from a producing industry. Alternatively,
element of any row in the table indicates the dollar amount of sales
producing industry to a consuming industry.

The transactions table can be expressed by the following system

$$(1) \quad X_i = \sum_{j=1}^{n} x_{ij} + Y_i \quad \text{where } i, j = 1, 2....n$$

$n$ = number of industries in the economy

$X_i$ = total output in industry $i$

---

*Exogenous variables are those elements in the model that must be spe
independently. Endogenous variables are those elements in the model
is determined by the model, i.e., the dependent variables.

technical coefficients expresses each cell element in the first
transaction table as:

$$(2)\quad \frac{x_{ij}}{X_j} = a_{ij} \qquad i, j = 1, 2 \ldots n$$

where $x_{ij}$ = sales by sector i to sector j

$X_j$ = total purchases (or gross outlays) of sector j.

$a_{ij}$ = technical coefficient, or the proportion of tot
of product j that is accounted for by the cost
i.

The technical coefficients table, usually referred to as t
indicates the interindustry linkages among industries in a give
economy. It can be used as a basis for estimating the total mu
(direct and indirect) of an exogenous change in sales to final
example, suppose that exports from the agriculture sector incre
technical coefficients table tells you how much the agricultura
purchase from other industrial sectors in order to produce that
additional sales to final demand. Let us assume that the agric
must purchase 28 cents of output from itself, 11 cents output f
facturing sector and 17 cents output from the services sector.
first round transactions (i.e., the "direct effects"), because
to sell 28 cents to itself it must again purchase 8 cents more
cents times .28) from itself, 3 cents (28 cents times .11) from
and 4.8 cents (28 cents times .17) from services. Furthermore,
facturing and service sectors to sell to agriculture, they must
inputs from other sectors, as indicated in the technical coeffi
The process continues until, ultimately, the total amount each
required to produce is calculated. This process is the source
multipliers.

Matrix algebra provides a much simpler method to determine
plus indirect requirements resulting from a final demand change
one described above. Equation (1) above can be expressed in te

A = the technical coefficients matrix
Y = the vector of final demand

quation (4) can be reduced to:

5) $(I-A)X = Y$ where I = the identity matrix

o develop a solution, both sides of (5) are multiplied by $(I-A)^{-1}$:

6) $(I-A)^{-1}(I-A)X = (I-A)^{-1}Y$

which reduces to:

7) $X = (I-A)^{-1}Y$

on (7) is the mechanism through which I-O multiplier effects are ined. For example, if an economy's exports change due to some exogenou , the effect on totsl output (X) would be given through the $(I-A)^{-1}$ e matrix, the matrix of interdependence (i.e., direct and indirect) cients. There are three general types of multipliers calculated via on (7).

he first type measures gross output or sales, and is usually referred t inal demand multiplier. This multiplier measures the total output (dir lirect) required of the economy to support a $1 change in final demand n sector.* It is derived from an I-O model by summing the inter- ence coefficients in columns of the inverse matrix $(I-A)^{-1}$. The sum of olumn is the output multiplier for the sector named at the head of the .

he second type of multiplier measures the total employment generated by hange in final demand for a particular sector. The basic assumption ving the employment multipliers is that, for each endogenous sector, a relationship exists between employment and output. The most common I- ment multipliers are the Type I and Type II.

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art I, section K(2) for a brief discussion of how the final demand by is determined.

The direct employment coefficient is obtained for each sector of the
by dividing total sector employment by total sector output. The di
Indirect employment effects are estimated for each sector by multiply
rse matrix, with households exogenous, by a row vector of direct empl
ficients (which is merely a matrix of ratios of employment to output
sector in the model), and summing the products for each sector (colu
nverse matrix. Direct, indirect, and induced employment effects are
ated by multiplying the inverse matrix, with households endogenous,
vector of direct employment coefficients, and summing the products fo
n in the inverse matrix.*

The direct employment coefficient of a sector multiplied by that sec
e in final demand provides an estimate of direct employment effects
ting from the final demand change. This estimate multiplied by that
r's employment multiplier equals total estimated employment changes
my due to the given change in final demand.

The third type of multiplier is the income multiplier, which measure
otal change in personal income resulting from a $1 change in income
sector in response to a final demand change. There are Type I and
e multipliers, which are similar to Type I and Type II employment
pliers.

Direct income coefficients for each sector are found in the househol
f the technical coefficients matrix, where households are endogenous
the household row of the payments sector, where households are exog

To compute the direct and indirect income effects of a sector (Type
plier), each column entry for that sector in the interdependence coe
s (inverse) matrix is multiplied by the corresponding household row
rect income coefficients vector. This multiplication is carried out

---

eholds are "endogenous" when they are treated as another industry in
(i.e., they appear in Quadrant II of the transactions table). Hous
exogenous" when they are treated as primary inputs (i.e., payments)
r in Quadrant III.

eholds endogenous). The household row of the new matrix yields the dir
rect and induced income effects for each column sector.

Although the I-O analysis can provide considerable insight into the
cture and interaction among sectors of an economy, the approach has sev
tations. First, the assumption of constant production coefficients (i.
s) implies that a doubling of inputs will lead to a doubling of output.
r this assumption, economies of scale are effectively ruled out. Innov
changes in production techniques are also unaccounted for. This omissi
e particularly important for newer industries, such as solar energy or
ervation that are expected to automate and innovate significantly as th
re. The seriousness of the problem will vary with the length of the
cast period.

The assumption of constant coefficients is also inaccurate in cases
localization and urbanization economies develop. The former arise
many plants in the same industry locate in close proximity to each oth
rnal economies accrue to individual firms since many ancillary firms wi
locate around such an agglomeration and provide specialized services a
r costs. Urbanization economies occur when firms in different industri
te in close proximity to each other and a corresponding infrastructure
t to service them.

Similar limitations apply to the use of direct employment coefficients
e coefficients are based on the assumption of relatively full utilizati
ently employed labor. If a sector was known to have significant under-
oyment at the time of the development of the basic model, use of the di
oyment coefficients is likely to overstate the direct employment effect
eased output. In such instances, the direct coefficients should be adj
eflect the changes in labor productivity that occur when labor becomes
oyed.*

Although this conceptual limitation is significant, it is not insurmou
methods can be used to adjust the input-output coefficients to take acc
echnological and productiviety changes. The first involves adjusting

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: The Use of Input-Output Analysis, op. cit., page 52.

Methods for correcting these and other estimation errors in I-O
re described in:

> Net Energy Analysis: Handbook for Combining Process and In
> Analysis. Clark Bullard, Peter Penner and David Pilati, Ce
> Advanced Computation, University of Illinois, Urbana, Illin
> 1976), CAC Doc. No. 214. Price: $5.

The static I-O analysis also assumes that both supply and demand
mpletely elastic. This implies that additional inputs are forthcom
t a constant price and that any quantity of product can be sold with
ffect on price. Although there are some methods available to estima
otential output of a resource constrained sector,** it is very diffi
ncorporate dynamic aspects into traditional I-O analyses.

eferences:

hree reports, available free of charge, provide a step-by-step descr
f the I-O methodology and its application:

> The Use of Input-Output Analysis. Regional Development and Plan
> U.S. Department of Agriculture, Economics, Statistics and Cooper
> Service. Agriculture Handbook No. 530.
>
> Input-Output Analysis Applied to Rural Resource Development Plan
> Clifford D. Jones, Jr. U.S. Department of Agriculture, Economic
> Statistics and Cooperative Service. ESCS-14.
>
> National Income and Product, Input-Output, and Employment Analys
> E. Kutscher. Office of Economic Growth, Bureau of Labor Statist
> Department of Commerce.

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ee: The American Economy to 1985, C. Almon, Jr., New York: Harper
66; and Bureau of Reclamation Economic Assessment Model: Technical
S. Department of Interior, January 1978, p. 23.

See: The Use of Input-Output Analysis, Regional Development and Pl
aluation, U.S. Department of Agriculture, Agriculture Handbook No.
-62.

these were then converted to employment. See:

Fiscal Impact of a New Industry in a Rural Area: A Coal Gasificat Plant in Western North Dakota, in: Regional Science Perspectives, 1976 (published by the Mid-Continent Regional Science Association) Reprints are available, free of charge, from the Department of Agr Economics, North Dakota State University, Fargo, North Dakota 5810

etailed bibliography on I-O analysis is presented in appendix D.

The following section provides a list of export base and I-O model can be used to determine indirect/induced employment and earnings erences and costs of this type of information is presented. Those m t have already been described in the previous section will be referr y briefly here.

C. Export Base Models. There are two easily accessible export ba els that can be used to determine the "non-basic" employment and ear ociated with energy development. These are the Argonne SEAM model ( efly in part I) and the Bureau of Reclamation Economic Assessment Mo EAM).

(1). SEAM. The SEAM model determines a simple ratio, complex rat a ratio computed by regression analysis for the counties studied. ression coefficient multipliers were derived from the following esti ation:

$$S = \underline{M} + B_1 AM + B_2 FC + B_3 T$$

where S = number employed in service (or "non-basic" industries)
AM = combined number working in agriculture or mining
FC = manufacturing and construction employment
T = transportation employment

In addition, the equation includes control variables (e.g., number ilies below poverty, average family income, etc.) when significant. uld be reminded that the regression coefficient multipliers $B_1$, $B_2$ a must be increased by 1 to be comparable to the ratio multipliers.

The product of the chosen Argonne employment multiplier and the ch struction or operation jobs associated with an energy project in a g lds the total employment effects. In addition, the Argonne model pr

year 1, 71 percent; year 2, 17 percent; year 3, 8 percent; year 4, 4

The Argonne multipliers and lag factors are presented and descr in:

A Framework for Projecting Employment and Population Changes Ac Energy Development: Phase 1. Erik J. Stenehjem and James G. M Argonne National Laboratories, August 1976.
Cost: $0.

For an excellent, well-written description of how to use SEAM multip assess the economic effects of nuclear powerplant construction in a region, see:

An Economic Impact Analysis of Energy Facilities with Particula to the Hartsville, Tennessee Area (Preliminary Report) by Walte Thomas A. Reiner and Roger Van Zele, Oak Ridge National Laborat Ridge, Tennessee ORNL/TM-6627 (May 1979).

Available from NITS, U.S. Department of Commerce, 5825 Port Roy Springfield, Virginia 22161. Price: Printed copy $4.50; micro $3.00.

An official procedure for public use of SEAM has not yet been establ Direct all requests to Erik Stenehjem, Roger Shull or Ron Matheny (s section K(1a) for their addresses and phone numbers).

(2). BREAM. The BREAM model can be used to determine the tota and income effects associated with a new energy facility on the coun Unlike the SEAM model, however, the user must specify the direct (or employment associated with the energy facility; BREAM then estimates secondary effects, using export base theory. The model is organized submodels:

- o Demographic Submodel, a cohort-survival model which ar effects of natality, mortality and migration on all ma ulations of the local area to make county specific pop projections;

- o Economic Submodel, an export-base model which determin employment and total personal income associated with t economic activity. First, basic labor income is deriv

sum of basic labor income, non-basic labor income, and non-labo income (i.e., including transfer payments, dividends, interest, rent, and excluding social security payments). Non-labor incom is partly endogenous, and partly determined outside the model.

- Labor Market Submodel, which evaluates the consistency of the output from the demographic submodel with that from the economi submodel; i.e., is the number of jobs roughly equal to the numb of persons willing and able to assume jobs. If there is an exc of jobs relative to the size of the labor force, it is assumed that balance will be reestablished between the supply and deman for labor by immigration. If, on the other hand, there is exce supply of labor, it is assumed that outmigration will occur. Whenever migration occurs, it is necessary to iterate back thro the demographic submodel so that the county population can be appropriately adjusted.**

- Community Allocation Submodel, which allocates the population determined in the demographic submodel to communities within ea county.

BREAM approach has a major advantage over SEAM and other traditional se models: it adds an income sector to the estimation process that sic jobs according to earnings per employee differentials. In this analysis can differentiate among energy facilities with different wa es.

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omic submodel includes the followig BEA industry sectors: farm ors, laborers), mining, contract construction, manufacturing, trans-/communication/public utilities, wholesale and retail trade, finance /real estate, services, government and other (non-farm proprietors).

el also includes a construction worker submodel. This submodel s local/non-local mix of construction workers, estimates the demogra istics of immigrating workers and their families, and allocates them es within the county.

- For the Demographic Submodel:

  --Total births by county by year;
  --Total population by community for 1970 and first forec
    period;
  --Death or survival rates by age and sex;
  --Fertility rates by age of mother;
  --Educational outmigration rates by age and sex by count
  --Nonresident college population by county;
  --Age distribution for retirement by county;
  --Retirement migration.

- Construction Worker Submodel:

  --Project employment by year;
  --Proportion of nonlocal construction married but withou
    families;
  --Average number of nonlocal construction workers per ho
    unit;
  --Indirect purchases of locally produced goods or servic

- Labor Market Submodel:

  --Total labor force by county;
  --Total employment by county;
  --Labor force participation rates by age and sex and by

- Community Allocation Model:

  --Average number of persons per household by county;
  --Average household size for person 60 years of age and
  --Change in average household size;
  --Project to community distances.

The estimated time for collecting this data initially is ab
hours. The work can be done by graduate students (@ $6/hr.), fo
about $480-$600. This process will become shorter and less cost
becomes internalized in the model over the next year.

odel has not yet been established. All requests should be directed to

Randy Threadgill
Bureau of Reclamation
Denver Federal Center
Denver, Colorado
303/234-3166

The BREAM approach is also available in a model developed by the S
rizona.** The Arizona Economic Demographic Projection Model (EDPM) ma
mployment and income projections to 2000 for all counties in Arizona.
f running the model is $50-$75 per run (staff and computer time). The
un for Arizona is already on file. The model could be purchased and a
ther states. However, because of the limited documentation of EDPM, p
sers are advised to use BREAM for regions other than Arizona. Contact

Bryan Meincke
Department of Economic Security
Office of Planning (0452)
P.O. Box 6123
Phoenix, Arizona 85007

eferences (free of charge):

Bureau of Reclamation Economic Assessment Model (BREAM) Technical Description. Bureau of Reclamation, Engineering and Research Cent Denver, Colorado 80225. Prepared by: Mountain West Research, Inc Temple, Arizona. January 1978.

Economic/Demographic Assessment Manual. Bureau of Reclamation. Engineering and Research Center, Denver Federal Center, Denver, Co 80225. Attention: 922.

The Arizona Economic Demographic Projection Model (EDPM). E. J. A T. L. Beckhelm and W. M. Hannigan. Office of Economic Planning an Development, Phoenix, Arizona (1977).

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Submodels cannot be run separately.

*EDPM was, in fact, the forerunner of BREAM.

relies heavily on data input by the user which, in this case, is pri
Utah-specific. Hence, UPED is not readily adaptable for projections
than in Utah. For more information, contact the Office of the State
Coordinator (Salt Lake City, Utah).

D. Input-Output Models. Several I-O models are available for
determining the indirect/induced employment and earnings effects ass
energy development. These are:

(1). The Bureau of Labor Statistics Input-Output Model (BLS/I-O
described in part 1 of this section, can be used to determine total
earnings and output associated with alternative energy scenarios.

Availability and Cost of Information:

- o Input-Output Matrix. Data from 129 industries for 1976, 19
  1990 (projected) include: Input-output coefficient matrices
  final demand and components; civilian employment; and wage
  employment and output series by industry with additional an
  1958-74. Cost: $100.*

For users without access to computer facilities, the Office of Econ
has done some contract work to run the BLS model and provide analys
output. The cost depends on the task. For further information, co

Charles Bowman/Ken Rogers (202/523-9036)
Office of Economic Growth
Bureau of Labor Statistics
U.S. Department of Labor
Washington, D.C. 20212

References (with Applications to Energy/Employment issues):

An Analysis of the Macroeconomic Effects of Industrial Cogener
Development Using Input/Output Techniques and the DRI Quarterl
Macroeconomic Model. September 1978. JRB Associates, Inc., 8
Drive, McLean, Virginia 22102. Contact:

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*Note: This is the same tape used for obtaining employment and ear
ratios. See part 1, section K(2d).

ashington, D.C.
02/376-4827

r Employment Analysis of Alternative Energy Scenarios. U.S.
tment of Energy. Energy Information Administration (August 1978).
act: Ron Earley 202/633-2693.)

economic and Sector Implication of Installing 2.2 Million Residential
Units (Draft) Energy Information Administration (December 1978).
ct: Ron Earley.

The Brookhaven I-O/BESOM system can be used to evaluate the direct
ary employment effects of alternate energy scenarios on a national
e system can be segmented into three separate models: (1) BESOM is a
gramming model of the energy sector; (2) the BNL I-O model is a IIO
model* of the national economy; and (3) the linked BNL/BESOM model,
ines energy and nonenergy sectors to evaluate alternative scenarios.
ese models is described briefly below.

- o BESOM can determine the minimum cost allocation of energy supplies to meet energy demands. BESOM can also be used to determine some of the cost and economic impacts of specific demand/supply configurations. The user specifies a set of energy requirements defined by end-uses, a set of available energy resources and conversion technologies and costs. The eight end-product energy sectors in the model include:

| | |
|---|---|
| ore reduction feedstock | process heat |
| chemical feedstocks | water heat |
| motive power | space heat |
| air conditioning | electric power |

The 12 energy supply/conversion sectors in the BESOM model currently include:

| | |
|---|---|
| coal | refined oil products |
| crude oil and gas | pipeline gas |
| shale oil | coal combined-cycle electric |
| methane from coal | |

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1, section K(2a).

sectors, see attachment to table C-4, in appendix C.

- o BNL I-O model has 110 sectors with "A" matrix coefficients and final demand, total output, employment and earnings vectors forecasted for 1985. Several distinguishing characteristics of the BNL I-O model differentiate it from conventional interindust I-O models:

  --The BNL model is composed of energy and nonenergy sectors with the output of the energy sectors expressed in terms of physica Btu units (the nonenergy sector is expressed in constant dolla

  --Outputs of the energy supply/conversion sectors are distribute to energy product sectors instesd of directly to consuming sectors. The supply sectors convert and distribute raw fuels sectors producing traditional energy forms. The outputs of these supply/ conversion sectors are then distributed to energ end-product sectors. (See table C-4 and attachment.)

he "A" matrix for the BNL I-O model has the following form:

| | | S | P | I |
|---|---|---|---|---|
| Energy Supply/Conversion | S | $A_{SS}$ | $A_{SP}$ | 0 |
| Energy Products | P | $A_{PS}$ | 0 | $A_{PI}$ |
| Nonenergy Sectors | I | $A_{IS}$ | 0 | $A_{II}$ |

ere:

$A_{SS}$ = input-output coefficients describing sales of the output of one energy/supply conversion sector to another energy conversi sector and conversion losses incurred in producing or distributing energy.

producing sectors; energy products are used by the nonenergy producing sectors.

$A_{PS}$ = input-output coefficients describing how energy products--fl energy forms--are used by the energy-supplying industries. Included here would be electricity use for lighting a refine

$A_{PP}$ = 0 implying that energy products are not used to produce ener products.

$A_{PI}$ = input-output coefficients describing how energy products--fi energy forms--are used by nonenergy-producing sectors. This submatrix describes the ways end-use energy forms are used in the nonenergy-producing sectors. Examples are blast furn heating or space heating.

$A_{IS}$ = input-output coefficients describing the uses of nonenergy materials and services by the energy industry such as pipes pumps.

$A_{IP}$ = 0 implying energy product-sectors equipment require no material or service inputs. This is because they are pseudo sectors and not real producing sectors.

$A_{II}$ = input-output coefficients describing how nonenergy products are used in the nonenergy-producing sector. An example woul steel for golf clubs.

tructure, which allows the specification of transactions in terms of f d-use, has certain important advantages:

- Conservation owing to technical improvements or reductions in consum demand may be implemented by modifying the $A_{PI}$ coefficients or final demands for energy products. This is more direct and realistic than modeling reductions in the demand for energy products by reducing th sales of several primary or secondary energy sectors as would be req in a conventional input-output model.

- The BNL/BESOM linked models provide for the endogenous esti $A_{SS}$, $A_{SP}$, derived from the BESOM solution output. Likewise linked version allows interindustry demands for energy prod those variables that are required for GNP determination mus specified exogenously. These variables (personal consumpti ment, etc.) can be determined by linking the BNL/BESOM mode Long-Term Interindustry model or the Hudson-Jorgenson Long- Interindustry Transactions model (H-J).*

Brookhaven National Laboratories is in the process of incorpor the SERI data base for 16 solar technologies in the BNL/BESOM syste part 1, section G). This work will be completed by late summer 197

Cost and Availability of Information:

As in the case of the BLS I-O model, data tapes for the BNL I-O/BES readily available to the user with computer facilities. Brookhaven arrangements for users outside of the Federal Government to buy com off BNL computers. However, it is virtually impossible for a non-F Government user to purchase staff/analyst time from the National La The fee structure for data tapes and computer time are:**

---

*For a description of these long-term models and their applications Estimation of the Short-Term Macroeconomic Impacts of Energy Price the U.S. Economy, (appendix A), JRB Associates, Inc., McLean, Virgi 1978); A Comparative Assessment of Energy-Economy Interactions: Pr Growth, (DRAFT: January 1979) Richard Goettle, Edward Hudson, Joar Brookhaven National Laboratory; and Energy Conservation Policies, E Mechanisms, and Impacts, (December 1978), Edward Hudson and David E Brookhaven National Laboratory.

**See part 1, section K(2a) for the free information available on e employment and occupational mix from the BNL model.

| Cost | Use in Lieu of Microfiche | (Computer Time Only) |
|---|---|---|
| ESOM | free | $200 |
| NL I-O | free | $100 |
| ESOM/BNL I-O | free | $300 |
| RI/BNL I-O | free | $200 |

OTE: The combined BNL I-O and Hudson-Jorgenson (H-J) macroeconomic
ot available through Brookhaven to outside users since the H-J mode
roprietary.

eferences:


Documentation of the Brookhaven Energy I-O and I-O/BESOM Linkag
Fraser. Brookhaven National Laboratory (August 1978).

Brookhaven Energy System Optimization Model Methodology and Doc
(Version 2.1). Cherniavsky, Juang, Kydes and Rabinowitz. Broo
National Laboratory (February 1978).

Applications of the model to energy issues:

An Energy and Economic Evaluation of Policies for Accelerated I
Efficient Automobiles. Walter Brooks, Steven Carhart, Gordon M
Shirish S. Mulherkar. Brookhaven National Laboratory (August 1
Preliminary Report.

Energy Employment, and Environmental Impacts of Accelerated Inv
in Conservation and Solar Technologies in Buildings. Steven Ca
Shirish Mulherkar, Jay Schwam. Brookhaven National Laboratory
1978). Preliminary Report.

A Comparative Assessment of Energy-Economy Interactions: Price
Growth. Richard Goettle, Edward Hudson, Joan Lukachinski. Bro
National Laboratory (January 1979). Draft.


ersonal Contacts:


Dick Goettle
Dale Jorgenson Associates
Department of Economics
Harvard University
122 Littauer Center
Cambridge, Massachusetts 02138

(subsequently revised) from data obtained by personal int
The model cost approximately $250,000 to develop. Descri
the methodology (including sample interviews) and potenti
applications is available in:

> Stimulating Regional Economic Development. William
> Miernyk et al. (Heath, Lexington Books, 1970).

The model includes sectors for two types of coal mining
(underground; strip and augur), for petroleum and natural
for electric and gas power systems. The model is on comp
available for less than approximately $100. Contact:

> James Maddy
> Governors Office of Economic
> and Community Development
> R151 State Capitol
> Charleston, West Virginia 25305

- Georgia. The Department of Industry and Trade financed t
development of a survey-based (for manufacturing sectors)
I-O. The 1970 model is available for 367-sector, 50-sect
30-sector aggregations corresponding to the national BEA
model. The model cost about $80,000 to develop in 1971.
Description of the model and applications is available in

> Using the Georgia Economic Model. William Schaffer,
> Laurent, Ernest Sutter, Jr., Office of Planning and
> State of Georgia. 1972.

The model includes individual sectors for petroleum produ
and utilities. It is available for use for less than $1,
Contact:

> Dr. William A. Schaffer
> College of Industrial Management
> Georgia Tech
> Atlanta, Georgia 30332
> 404/894-2600

which enables it to be used for projections to 1985 and 19
model cost approximately $200,000 to develop ($125,000 for
model; $75,000 for the econometric "linkage"). A descript
the model and its potential applications is available in:

The 1972 Washington Input-Output Study, by Phillip J.
Bourque and Edward J. Chambers, Seattle, Washington:
The Graduate School of Business Administration, Unive
Washington. June 1977.

The Washington Projection and Simulation Model. Phil
Bourque and Edward J. Chambers, University of Washing
September 1977.

The Input-Output Structure of Washington State, Phill
Bourque, Richard S. Conway, Jr., University of Washing
February 1976.

The model includes sectors for petroleum refining, natural
gas, electricity and mining. The cost of using the model
on the task. Contact:

Phillip J. Bourque
Graduate School of Business Administration
University of Washington
Seattle, Washington
206/543-4484

An inventory of regional and state input-output models and documenta
available in:

Regional and Interregional Input-Output Analysis: An Annotate
Bibliography, by Frank Giarratani, James D. Maddy and Charles
Socher, West Virginia University Library. 1976.

An Inventory of Regional Input-Output Studies in the United St
Occasional Paper No. 22 by Phillip J. Bourque and Millicent Co
Graduate School of Business Administration, University of Wash
Seattle, Washington. 1970.

Non-survey models adapt survey-based national or regional models to
economy through the use of secondary data sources (e.g., U.S. Census
employment departments).* Any primary data that the researcher can
low cost is also used in this estimation.

On balance, the non-survey approach to estimating regional I-O
represents a relatively cost-effective means for performing regional
It is no doubt less accurate than survey-based methods, but it is us
less expensive to develop. Non-survey models are more accurate when
evaluate exogenously generated impacts than for "structural" changes
"forecasts". But, in any case, diminishing returns set in rapidly i
data collection for the construction of an I-O model for a particula
Three non-survey regional I-O models are described in this report:
Industrial Multiplier System (RIMS)**, the Regional Science Research
Model (RSRI) and the Lawrence Berkeley Laboratory Model (LBL). The
described in a later section due to the relatively high costs involv
development and use. The RSRI and RIMS models are described below.

(4a). The Regional Science Research Institute Model (RSRI) pro
detailed estimates of regional impacts which result from the direct
stimulus provided by, for example, construction and operation of a n
or in the contraction of such an activity. The specific impacts tha
estimated are:

- o Economic activity, by industry;
- o Wage and salary income, by industry;
- o Employment, by industry;
- o Employment, by occupation;

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*See, for example: The Use of Input-Output Analysis, Appendix B,
U.S. Department of Agriculture, Economics, Statistics and Cooperativ
Service, Agriculture Handbook No. 530.

**See also part 1, section K(2b).

Emissions to water, by industry and type of emission.

el specifies 490 industry sectors (including separate sectors for steam engine manufacturing, electric companies and systems, gas es and systems, crude petroleum and gas) and 232 occupational categ ple C-8 in appendix C). The model can be adapted to any state, met area, or other grouping of contiguous counties, and can be modifie estimates for the subregions which constitute a region as well as ion as a whole. A typical adaptation costs in the neighborhood of but it could be significantly more depending on data problems, th n of subregional models, the addition of submodels for energy use, eneration, emissions to air, emissions to water, extra help in sett el up on a client's system, etc.

RI has adapted their model to several substate regions, including ladelphia SMSA, the Richmond, Virginia Planning District, the Balti d the New York-New Jersey metropolitan region. Once the model is a ts to RSRI of maintaining and running it are relatively low. A typ e of the prices charged by RSRI for simple analyses using an alread ed regional model is presented below:

RSRI Billing Fees for Standard*
Regional Input-Output Runs Done at One Time

| Number of Runs | Total Fee |
|---|---|
| 1 | $ 500 |
| 2 | 700 |
| 3 | 900 |
| 4 | 1,050 |
| 5 | 1,200 |
| 6 | 1,350 |

addition to this detailed, regional I-O effort, RSRI has also deve fied I-O model which is linked to an econometric description of ba

---

oance to final demand expressed as outputs of one or more four-digi (1967 SIC definition).

Virginia 22161) for under $100.*

Additional information on the RSRI Regional Models can be obta

Dr. Benjamin H. Stevens
President
Regional Science Research Institute
Wentworth Building
256 North Pleasant Street
Amherst, Massachusetts 01002
(Telephone: 413/256-8526)

Dr. Robert E. Coughlin
Vice President
Regional Science Research Institute
P.O. Box 8776
Philadelphia, Pennsylvania 19101
(Telephone: 215/222-3940)

References:

Richmond Input-Output Study: Volume II, Construction of the M
by Gene Steiker et al. RSRI, P.O. Box 8776, Philadelphia, Pen
19101 (August 1976).

Regional Economic Impact from Construction of a Nuclear Electr
Plant, by Gene Steiker and James Strathman. RSRI Discussion P
No. 91 (December 1976). This paper uses the Philadelphia SMSA

The Employment Sector of a Regional Policy Simulation Model, b
Treyz et al. RSRI Discussion Paper Series: No. 107 (November

*The "core" program described here is modeled after the Massachuset
Policy Analysis Model (MEPA), which includes the relationships that
models and also allows for substitution among factors of production
relative factor costs. MEPA cost $200,000-$300,000 to develop. To
arrangements for its use have been limited to state agencies and th
(for a subscriber fee of about $5,000). For more information on ME
applications, contact: George Treyz, Economic Department, Universi
Massachusetts, Amherst, MA. (413) 545-0915/2590.

Regional Science Research Institute) Preliminary Report (March 1979).

(4b). The Regional Industrial Multiplier Systems (RIMS), as described
1, section K(2b), can be used to determine the direct and secondary emp
output and earnings effects of energy choices on a regional level.

ability and Cost of Information:

- Multipliers for selected areas are available without charge from two sets. One set is estimated by BEA economic area (see figure 3 in section I) for 56 industries aggregated from the basic 484 national model industries. A second set is estimated, by state, for a 103-industry aggregation.

  Contact: Joseph Cartwright (202/523-0594)
  Regional Economic Analysis Division
  Bureau of Economic Analysis, BE-61
  Department of Commerce
  Washington, D.C. 20230

- Industry-specific multipliers are available from BEA for any region composed of one or more counties and for any of 484 industries. Re are reported in tabular form similar to the example in exhibit 2. Factors for converting a gross-output change to a change in earnings and employment are also provided.*

  Cost: $1,000 for each region. The user need only define the regio terms of counties.

  Contact: Joseph Cartwright (see above)

- Specifically tailored quick-response packages can also be developed through BEA contract arrangements, that will address analytical nee not covered by the standard output of the system.

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ier option available to the user (at additional cost) is the aggregati e sectors in the national I-O model.

Energy Information Administration
National Energy Information Center
Office of Energy Information Services
Attention: Heidi Sanford (202/634-5610)
Room 230
1726 M Street, NW.
Washington, D.C. 10461

The data is available on 8 files:

File 1: Census-Region Multipliers and Components. This f
16 sector industrial output multipliers and compo
census regions.

File 2: Multi-Region Multipliers and Components. This fi
103 sector industrial output multipliers and comp
each state and census region.

File 3: Census Region Direct Coefficients. This file con
direct coefficient estimates for 16 sectors in ea
region.

File 4: Multi-Region Direct Coefficients. This file cont
direct coefficients for 103 sectors in each state
census region.

File 5&6: Industry Earnings--Gross Output Ratios. This fil
industry earnings--gross ouput ratios for states
regions (in 1967 dollars).

File 7: Industry Employment-Earnings Ratios. This file c
industry employment-earnings ratios in the form o
estimates (weighted averages in 1967 dollars).

File 8: Inverse Matrices. This file contains the inverse
(103 sector) for states and consus regions.

System Name: Preliminary READ Model Data Base.

| IC | Industry Name | Elements of: Direct Component | Elements of: Indirect-Induced Component | Total Multiplie |
|---|---|---|---|---|
| 1 | Farms | .0934 | .0941 | .1875 |
| | Agricultural services | .0000 | .0092 | .0092 |
| 1 | Coal mining | .0000 | .0006 | .0008 |
| | Nonmetallic mineral mining and quarrying | .0000 | .0005 | .0005 |
| 5-17 | Contract construction | .0027 | .0063 | .0090 |
| 0 | Food and kindred products | .2851 | .0618 | 1.3469 |
| 2 | Textile mill products | .0000 | .0133 | .0133 |
| 3 | Apparel and other fabricated textile products | .0002 | .0112 | .0114 |
| 4 | Lumber and wood products, except furniture | .0000 | .0035 | .0035 |
| 5 | Furniture and fixtures | .0000 | .0008 | .0008 |
| 6 | Paper and allied products | .0536 | .0064 | .0600 |
| 7 | Printing, publishing and allied products | .0000 | .0023 | .0023 |
| 8 | Chemicals and allied products | .0000 | .0015 | .0015 |
| 9 | Petroleum and related industries | .0019 | .0041 | .0060 |
| 0 | Rubber and miscellaneous plastic products | .0001 | .0001 | .0002 |
| 1 | Leather and leather products | .0000 | .0053 | .0053 |
| 2 | Stone, clay and glass products | .0000 | .0007 | .0007 |
| 3 | Primary metals industries | .0000 | .0017 | .0017 |
| 4 | Fabricated metals products | .0003 | .0046 | .0049 |
| 5 | Machinery, except electrical | .0000 | .0002 | .0002 |
| 6 | Electrical machinery | .0000 | .0004 | .0004 |
| 71 | Motor vehicles | .0000 | .0000 | .0000 |
| 2-379 | Other transportation vehicles | .0000 | .0001 | .0001 |

This exhibit includes only some of the industrial sectors in the RIMS multiplier system,
nd is for illustrative purposes only.

Vol = SER = FE7985, F10972.

Requests should be made in letter form, and should indicate the type
form of information needed (e.g., data tapes or computer printout).

Costs: for tapes: cost of blank tape for all files listed above (a
$50);for computer printouts: minimal (about $10 to $25)

Bureau of Economic Analysis (BEA), in conjunction with the U.S.
nt of Housing and Urban Development (HUD) has recently developed RIM
ers for 46 construction industries in 61 SMSA economic areas. For 2
SA areas, BEA also disaggregated the multipliers into "core county"
-core county" (i.e., suburb) multipliers. BEA has put together a pa
ng the multipliers for the 61 SMSA areas, entitled:

Regional Impact of Changes in Construction Spending: An Analysis o
A Multiplier Differentials (mimeo June 1979) by Joseph Cartwright,
olph Depass, Richard Gustely, and James Younger. Regional Economic
lysis Division, Bureau of Economic Analysis, U.S. Department of Comm

is in the process of developing a similar paper for the "core" and
e" multipliers associated with construction industries in the 20 SMS
For more information on these multipliers, contact:

Richard Gustely (202/523-0953)
Room 305
401 K. Street, NW.
Washington, D.C. 20230

RIMS multipliers are also used as input into a local impact assessm
veloped by the Energy Systems Research Group, Inc. (ESRG). The ESRG
s the following features:

A data base containing information on cost, labor requirements
and energy savings for various residential energy technologies.

A financial package allowing the user to develop implementation
rates for residential energy technologies under alternate financial
assumptions. Data in technologies can come from the ESRG data base
elsewhere.

currently in progress on a commercial sector data base and a
ompute "public benefits."

prepared to run specific analyses developed by clients and/or to
evelopment of a client's program. For the analysis of a well-
energy program using ESRG data, or a client's data base which is
he cost would run about $6,000. This includes the purchase of one
ltipliers for the region under consideration. For further
contact:

Stutz
y Systems Research Group, Inc.
Milk Street
on, Massachusetts 02101
) 426-5844

he INFORUM model, developed at the University of Maryland's
Economics Research Project, is a 200-sector national input-output
ed to produce annual projections over a 10 to 15-year time horizon
s the base year). The INFORUM model forecasts the sales of each of
ors:

as material or service inputs in the production of the 200 products;

as materials used in 30 construction activities;

as capital equipment purchases by 90 industries (which are aggregates of the 200 sectors);

as purchases for six categories of Government operations;

as exports (offset by imports as a negative entry);

as inventory change;

as personal consumption expenditure.

el also provides forecasts of prices and wages of the 200 sectors,
nt in the 90 aggregate sectors. INFORUM has also been used to

Table C-9 in appendix C lists the 200 sectors in the INFORUM model
ıeir corresponding SIC codes. Note that the model includes separate
r coal mining, crude petroleum, natural gas, petroleum refining, fue
lectric utilities.

ailability and Cost of Information:

he INFORUM model is available for use only to subscribers.

Cost of annual subscription: $5,000.

Contact: Margaret Buckler/Clopper Almon
Economics Department
University of Maryland
College Park, Maryland 20742
301/454-5384

eferences:

A Brief Description of INFORUM, Interindustry Forecasting Project
University of Maryland (November 1978).

1985: Interindustry Forecasts of the American Economy, C. Almon,
Buckler, L. M. Horwitz, and T. C. Reimbold. Lexington, Massachus
heath, 1974.

(6). The REAP model, as described in part 1, section K(2c), can
nformation on the direct and secondary employment effects of energy d
ı western North Dakota.

vailability and Cost of Information:

- o REAP model run for a single energy expansion scenario: free of charge
- o REAP model run for two energy scenarios: less than $10

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See: Employment Impacts of Achieving Federal Energy Conservation Goa
ertaining to Automobile MPG Efficiency, Home Retrofitting and Industr
se for the Period 1978-1985; Douglas C. Dacy, Robert E. Kuenne and Pa
stitute for Defense Analysis, Arlington, Virginia. IDA Paper, P-134

REAP has been made available to Texaa, free of charge, for adap
e state's economy. Adaptation of the REAP model to Texas is expec
equire 3 months of work by professionals in regional economics, 3 m
rk by economic/demographic analysts, and 3 months of work by compu
ogrammers. The estimated cost of this project is $30,500:

| | | |
|---|---|---|
| Professionals: | 5 months @ $25,000/yr. = | $10,500 |
| Economic/demographic analysts: | 8 months @ $1,000/mo. = | 8,000 |
| Computer programmers: | 6 months @ $1,000/mo. = | 6,000 |
| Computer time | | 3,000 |
| Travel and data collection expense | | 3,000 |
| | Total | $30,500 |

rsonal Contacts:

Glen D. Schaible
Research Coordinator
Regional Environmental Assessment Program
Suite 521
316 North Fifth Street
Bismarck, North Dakota 58505
(701/224-3700)

r information on the Texas adaptation of REAP:

Larry Leistritz (701/237-7441)
Department of Agricultural Economics
North Dakota State University
Fargo, North Dakota 58105

(7). The Lawrence Berkeley Laboratory (LBL) has developed a na
gional modeling capability to assess the direct and indirect emplo
come effects associated with alternative energy scenarios. LBL ha
e 1967 BEA national I-O table to 1972 and disaggregated the 7 mine

ionalize the national I-O to each state. Regional I-O tables have al
n developed for the eight Rocky Mountain States and California, as de

Development of State Interindustry Models for Rocky Mountain
and California. Jayant Sathaye and Leonard Kunin. Energy An
Program. Lawrence Berkeley Laboratory. LBL-4465. February
Coat $4.50 (microfiche: $3.00), available from:

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, Viginia 22161

In addition, LBL has the capability to regionalize the Bechtel ESPM
e to each state. Figure 6 illustrates the general methodology linkin
rgy supply planning models with the input-output models.

ilability and Cost of Information:

The cost of regionalizing the ESPM and I-O models, running the mode
lyzing the results for various energy scenarios is approximately $100
s cost is significantly leas for those states for which interindustry
regionalized ESPM data has already been developed. These include:
ifornia, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah
ing.

An example of this type of analysis, performed for the State of Cal
LBL, is presented in:

Analysis of the California Energy Industry. Energy and Enviro
Division, Lawrence Berkeley Laboratory. (January 1977).

further information contact:

Jayant Sathaye
Lawrence Berkeley Laboratory
University of California
Berkeley, California 94720
415/451-6292

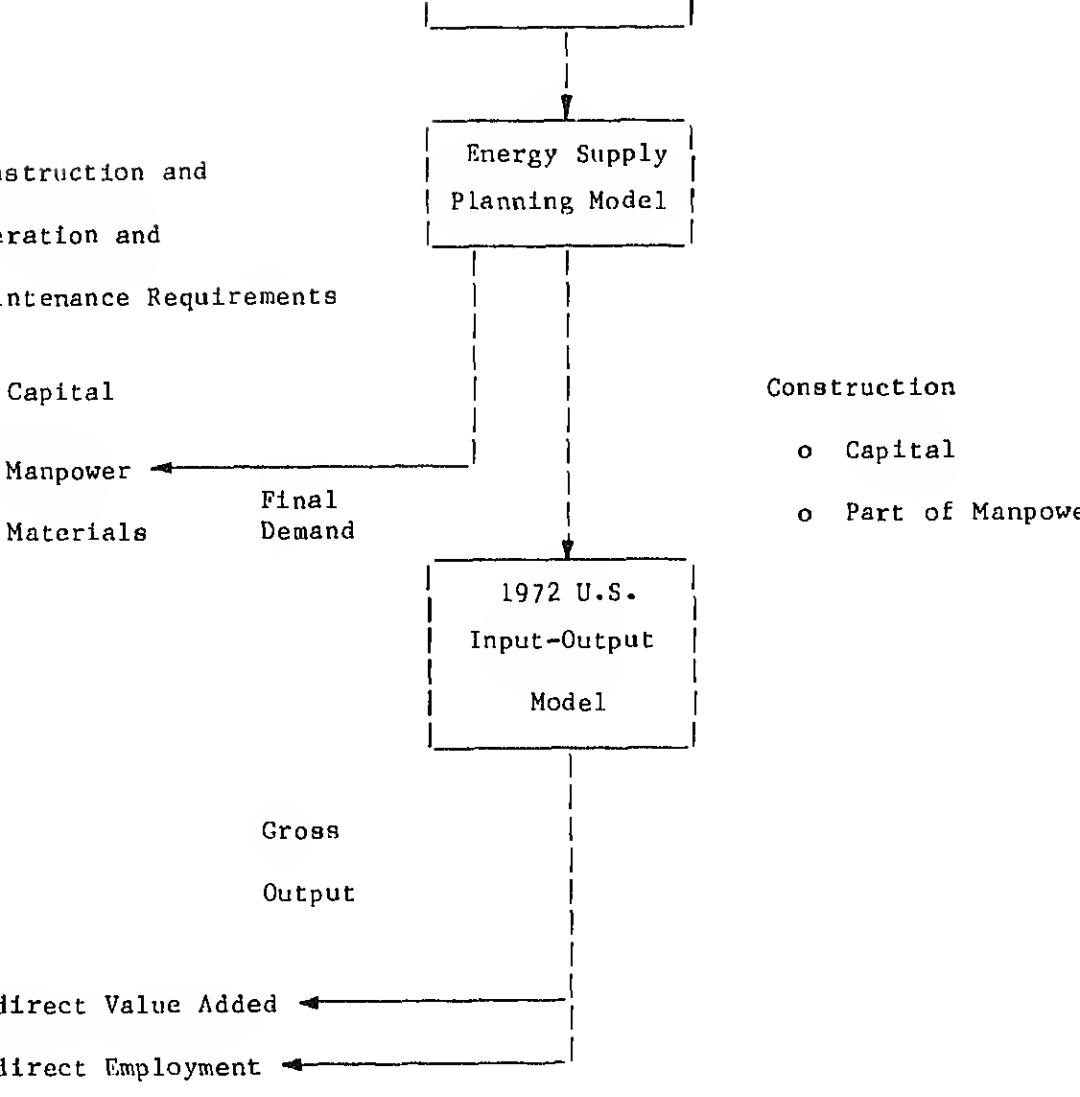


Figure 6: Analytical Methodology for Lawrence Berkeley Laboratory Model

- o The policy question requires analysis of the total net employ impact associated with each energy alternative and the job c associated with the displaced system is realized in the loca

- o The policy question requires a comparative analysis of net e impacts among energy alternatives and the alternative have d total costs or they each displace different energy sources.

The sources for direct and indirect/induced employment effects 2) can be used to determine the cost and availability of information displacement effects.

Part 4. Respending/Substitution Effects. In addition to the d indirect/induced and displacement effects, there is another effect t if the energy source encouraged through policy measures incurs diffe costs than the next best alternative. If this energy source is less real economic growth (and hence employment and income growth) occurs resource savings are "respent" on additional goods and services. Co energy source that costs more per energy output than its alternative made available to the public, can decrease overall employment and ea diverting spending from other (more labor intensive) sectors of the The former situation is referred to as the "respending effect"; the the "substitution effect." The respending/substitution effects will estimation in almost all cases where energy alternatives have unequa The major exception is when energy alternatives are compared for a v undiversified economy, where most of personal consumption expenditur investment are made outside the region (see section I).

In order to estimate the respending/substitution effects asaoci with energy policies, it is necessary to determine:

(1) The real resource (i.e., unsubsidized) costs of the energy be encouraged and of its competing energy source(s) over t vation period. The difference between these costs represe energy cost savings/increases associated with a particular policy.

(2) Who realizes these energy cost savings/increases--private consumers or the Government?

financed (i.e., from reductions in consumer expenditures, inve
or increased Government debt)?

(4) What are the employment and earnings effects associated with a
dollar increase/decrease in consumer expenditures, investment
Government debt?

It should be noted that the importance of these considerations will
ffer significantly across regions. For example, if the subsidies to c
onal energy are primarily Federally funded, then individual communitie
t need to factor these subsidies into their energy costs. This is bec
at of Federal subsidies is spread over the entire Nation. Any one com
only negligibly affected. On the other hand, the magnitude of these
ll make a difference to the Nation as a whole, or to large subnational
milarly, any consideration of cost-savings and how they are spent may
relevant to a small region (where most goods and services are imported
rger, well-diversified economies, however, these considerations will b
portant.

Unfortunately, there are large gaps in information about the real r
sts of energy, the behavior of energy consumers facing changes in ener
sts, and the effect of different types of expenditures on employment a
rnings in the economy. A discussion of some of the relevant sources f
pes of information is presented below.

A. Real resource costs of energy. There is very little informatio
the real resource cost of conventional energy sources, mainly because
at cost is "hidden" by existing pricing policies and a variety of dire
direct subsidies. A recent analysis by the Battelle Pacific Northwest
boratory* indicates that the Federal Government has provided on the or
00 billion in support of conventional energy over the 1918-1977 period
ble 6). While issue may be taken with the exact figure, it is clear t
nventional energy aources have been substantially subsidized.

Price regulations, however, provide a much larger price advantage t
nventional fuels. Electricity, gas and oil were sold last year substa
ally below their replacement costa, due in part to Federal price contr
l and gas, and in part to state-regulated, average-cost utility rate
ructures. A preliminary analysis by the Department of Energy compares
verage user prices of oil, gas and electricity with their replacement c

---

n Analysis of Federal Incentives Used to Stimulate Energy Production,
ttelle Pacific Northwest Laboratories, March 1978.

Due to the paucity of information in this area, it is virtua for policy analysts to accurately project real resource costs of energy for their area. Hence, the analysis is limited to the use user price projections. In the case of oil and gas, where prices to gradually increase to their replacement costs, this omission i serious. In the case of electricity, however, user prices will b indicator of resource costs in areaa where utilities continue to rate structures. Analysts who are trying to quantify the cost di among energy alternatives should always note this discrepancy. A can be made by performing "sensitivity analysis." For example, t can first estimate the positive direct and secondary employment e energy alternative, and then determine how high the energy costs either offset these effects, or make one indifferent between the ment in question and an alternative one. These "implicit" replac then be compared to those in table 7 (after taking account of rea cost escalation) to assess whether they are at all reasonable exp the future.

There are many sources for energy user prices, including loc energy companies, local, state and national energy offices and re tutions (see, for example, a description of the Bechtel and SERI section I, part 1). Useful data is alao available from recent pu including:

- o 1977 Annual Report to Congress. Vol. I, II, III, Energy Administration, U.S. Department of Energy DOE/EIA-0036/1, 1978). This report contains historical data and projecti energy use and energy prices by sector. Energy sources i electricity, natural and liquid gas, petroleum products a regional information is also available, although detailed

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*The Domestic Policy Review of Solar, A Response Memorandum to th December 1978. Available from: U.S. Department of Energy, Advan Systema Policy Division.

**It should be noted that these comparisons do not capture the wi regional variability. For example, current gas prices range from San Francisco-Oakland to $4.05/mmBtu in New York. In all-electri heating rates range from $3.25/mmBtu in Seattle (the next lowest Chicago) to $17.80/mmBtu in New York.

TABLE 6. An Estimate of the Cost Incentives Used to Stimulate Energy Production (in Billions of 1977 Dollars)

| | Nuclear | Hydro | Coal | Oil | Gas | Electricity | Total | Percen Total I |
|---|---|---|---|---|---|---|---|---|
| | | 1.8 | 4.03 | 50.4 | 16.04 | 31.37 | 103.64 | 4 |
| nents | | | | 1.1 | | | 1.10 | |
| ents | 1.1 | 0.03 | 0.67 | 41.9 | 0.06 | | 43.76 | 2 |
| nal Services | | | 2.31 | 6.0 | | 0.48 | 8.79 | |
| itional es | 15.1 | | 2.68 | 1.5 | 0.3 | | 19.58 | |
| ctivity | 1.8 | 13.5(a) | 0.02 | 0.4 | 0.1 | 24.73(a) | 40.55 | 1 |
| | 18.0 | 15.33 | 9.71 | 101.3 | 16.50 | 56.58 | 217.42 | 1 |
| of Total ves | 8.3 | 7.0 | 4.5 | 46.6 | 7.6 | 26.9 | 100.0 | |

lue based on incentive definition 1 (Federal money outstanding).

| | ($ /mm8tu) | ($ /mmBtu) | ($ /m |
|---|---|---|---|
| Natural Gas[a] | | | |
| Residential | 2.80 | 2.56 | 0 |
| Commercial | 2.80 | 2.28 | 0 |
| Industrial | 2.80 | 1.87 | 0 |
| Utility | 2.80 | 1.60 | 1 |
| Electricity[b] | | | |
| Residential | 10.21 | 9.59 | 0 |
| Commercial | 10.21 | 9.50 | 0 |
| Petroleum Products[c] | | | |
| National Average | 2.80 | 2.33 | 0 |

[a]Replacement cost represents the delivered price of industrial disti
at current world oil pricea. Average prices represent 1977 user pri
to 1978 dollars.

[b]Replacement cost represents in-service costs for a new baseload coa
powerplant using bituminous coal, scrubbers at 85 percent removal ca
This cost includes all of transmission costs and 25 percent of distr
costs. Baseload costs were used because in 1977, solar generally co
baseload generation. Coal was used here because it represents the m
type of baseload plant, thus, providing an upper-bound estimate.

Average electricity pricea for 1977 were adjusted to 1978 dollars.
75 percent of the average distribution cost was deducted from averag
This adjustment was made because potential solar users will already
to the grid for lighting and other uses of electricity. Hence, the
additional electricity will generally include only a fraction of dis
costs.

[c]Replacement costs represent the average landed price of imports in
(1978) dollars, converted into mmbtu at 5.8 mmBtu/bbl. Average pric
refinery acquisition costs.

Source: The Domestic Policy Review of Solar, A Response Memorandum
Preaident, December 1978. Available from: U.S. Department
Advanced Energy Systems Policy Division.

Applications of Solar Technology to Todays Needs. Vol. 1 and 2. Office of Technology Assessment, U.S. Congress, Washington, D.C., September 1978. This is an excellent aource of information on so applications and includes cost projections for solar and conventi energy in four sample cities: Albuquerque, New Mexico; Boston, Massachusetta; Fort Worth, Texas; and Omaha, Nebraska. Available the Superintendent of Documents, U.S. Government Printing Office, Noa. 052-003-00539-5 and 052-003-00608-1.

New England Blueprint for Energy Action. (March 1979) By the New England Energy Congress, presents projections of energy costs (to consumer) to the year 2000 for New England. The energy sources i solar, gasoline, natural gas, heating oil, wood and residuals, co electricity (by fuel type). For a copy of this report write to:

New England Energy Congress
14 Whitfield Road
Somerville, Massachusetts 02144
617/625-6528

. Who realizes energy cost savings/increases? This part of the ding/subatitution effect is usually predetermined by the policies e d to encourage a particular energy source over another. For exampl ergy source is encouraged via mandatory requirements, then private will realize any energy cost savings or bear the burden of any cost ses.* Alternatively, if the use of a particular energy source is aged through Government aubsidies (such as tax credits, subsidized , etc.), then the Government will pay for the difference in energy

. Behavior of energy consumers facing increased/decreased energy Once it is determined who realizes energy cost savings/increases, necessary to determine how these cost changes affect consumption an ment. It is particularly difficult to determine these effects if t

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ublic sector also realizes energy cost savings/increases if it ia ed to use a particular energy source (e.g., in public housing or mi ngs).

If private energy consumers experience changes in energy costs, are several steps in estimating the effect of these changes on consu investment patterns. First, it is necessary to determine the types users affected by the energy policy (i.e., households or businesses). usually determined by the energy regulations themselves: many of the directed towards specific end-use sectors (i.e., residential, commerc industrial*). Analysis of energy consumption patterns by sector may if a general energy source is encouraged by the policy in question (s or gas). This information can be obtained from local energy companie utilities, or local, state and national energy offices (see the refer section A above).**

Second, it is necessary to determine the extent to which an addi dollar of income is consumed or saved/invested by households and busi The following references are useful for obtaining this information:

- o Sourcebook: Statistics of the Income; Active Corporation Inc Returns, U.S. Internal Revenue Service, provides information corporate profit levels, percentage reinvested and percentage as dividends. Available for reference use in most major libr

- o The BLS 1972/1973 Consumer Expenditure Survey, provides infor on taxes and consumption expenditures averaged over responder income class. This information can be used to estimate consu fraction of disposable income, or to analyze categories of co expenditures. For results of this survey, free of charge, co

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*Residential energy use is usually attributed to households. Commerc energy use refers to the use of energy in commercial/industrial build Industrial energy use usually refers to the use of energy for industr processes.

**In addition, information on energy use by industry is available in Annual Survey of Manufacturers: Fuel and Electric Energy Consumed by Manufacturers, Bureau of Census, which contains data for the Nation, SMSA's. Reports are available from the Government Printing Office fo dollars. Data tapes are available from Data Users Services Division Census, for about $80.

Washington, D.C.
202/523-9637

. The employment effects of respending/substitution. Once the effec
rgy cost savings/increases on consumption and investment are determine
necessary to relate these effects to changes in the level of employmen
arnings) in the economy. There are several methods that have been use
studies to determine this relationship:

- Input-output coefficients. The multipliers associated with the hous
sector in I-O models can be used to determine the average number of
labor years and earnings per million dollars of disposable income sp
in (or withdrawn from) the region. This procedure can only be used
I-O models that include households in the A-matrix (such as RIMS).
procedure is used in:

The Long Island Jobs/Energy Study, Council on Economic Prioriti
(April 1979 FINAL DRAFT).
Contact: Steven Buchsbaum
CEP
84 Fifth Avenue
New York, New York 10011
212/691-8550

See also:

Energy and Labor Impact of Final Demand Expenditures, 1963 and 1967, Robert A. Herendeen, et al., Center for Advanced Computat
University of Illinois, CAC Technical Memo No. 62 (October 1976)
Cost: $3.00.

Labor and Net Energy Effects of a National Ceiling Insulation Program, Charlotte Ford, CAC publication (September 1978).
Contact: Charlotte Ford, CAC
217/333-3242

This latter publication indicates that, in 1967, money invested in
average investments produced 9.2 jobs per $100,000 while money spent

Creation of Labor Data for 1963, 1967 and 1972, by Donna A
Technical Memo No. 77 (September 1976). Cost: $5.00.

- Income elasticities. For I-O models that exclude households in
A-matrix, the implicit income elasticities in macroeconomic mod
be used to estimate how a change in income will affect various
tion items. These changes can then be "mapped" into an I-O mod
structure to produce estimates of total final demand, earning a
employment. This has been done using the 1978 version of the D
Quarterly Macroeconomic Model of the U.S. Economy and the BLS n
I-O model. See:

Macroeconomic Impacts of Utility Retrofit Program-Solar.
(DRAFT: September 1978)
Science Applications, Inc./JRB Associates, Inc.
8400 Westpark Drive
McLean, Virginia 22102
Contract No. EM-78-C-04-4261
Contact: Jerry Lawry
202/821-4325

The Data Resources, Inc. Model, Otto Eckstein, Lexington,
Massachusetts (1978) "Consumer Spending," Table 2.

The preceeding discussion is designed to provide the policy decisi
a list of relevant considerations and sources of information for d
espending effects of energy policy choices. This list is by no me
ustive: It represents a useful starting point for continuing resea
ysis in this area.

Part 5. Financing Effects. As discussed briefly in section I, th
employment effect of a policy choice will also depend on the way th
gy investment is financed. The financing effects of energy policie
require estimation in almost all cases where the economy in questi
arge and diversified. For small, undiversified economies, financin
the energy investment will generally draw funds from outside the re
n the exception of direct local taxation).

In order to estimate the financing effects, it is necessary to det

Most of the discussion presented in part 4 ("Respending/Substitutio
ects") applies here. The answer to question 1 will usually be prede-
mined by the policies established to encourage a particular energy so
r another. Question 2 can be answered using the same references pres
: 4D. As in the case of respending/substitution effects, it is diffi
ermine the effects of financing on employment/earnings when public de
source of funding. If the investment is financed through private de
umptions must be made about the terms (length and interest rate) of t
order to determine the annual amount of funds being diverted from cor
enditures or savings/ investment. In addition, several "sensitivity
be done by varying the types of policies used to finance solar (e.g.
dits, grants, tax exempt bonds, interest subsidies). Comparing the e
nings effects associated with each policy alternative may provide a b
osing the optimal policy.

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olic investment is not directly included here because it is, in effec
anced through either increased taxation (and hence reduced consumptio
estment) or public debt.

# APPENDICES

This appendix presents, primarily in table form, a review of direct
indirect labor requirements for energy technologies from various writte
ces. It is expected that the policymaker can select pertinent informat
these tables, and make additions to this data when other, more specifi
rmation is available.

(1) Table A-1. This table summarizes the results of several studies
the direct labor requirements of solar flat-plate collector syste

(2) Table A-2. This table summarizes the results of several studies
(including those sources for table A-1) on the direct and indirec
labor requirements for passive solar and solar flat-plate collect
systems.

(3) Table A-3. This table summarizes the results of a MITRE study o
direct labor requirements for solar technologies, exclusive of f
plate collector systems.

(4) Tables A-4 to A-14. These tables summarize the results of a 197
Argonne National Laboratory study* which evaluated the construct
and operating labor requirements of various sized facilities for
of eight separate technologies: coal extraction, oil shale extr
and conversion, offshore oil and gas extraction, nuclear powerpl
coal-fired electric generating plants, gasification, liquefacti
plants, and geothermal facilities.

(5) Table A-15. Summarizes the results of a 1978 study by Charlotte
Ford at the Center for Advanced Computation, University of Illin
The atudy estimates the direct and indirect labor requirements f
manufacture, transportation, sale and installation of insulation

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ramework for Projecting Employment and Population Changes Accompanying
gy Development: Phase I. Erik Stenehjem and James E. Metzger, Energy
ronmental Systems Division, Argonne National Laboratory, Argonne, Illi
st 1976.

estimates relate to a program that includes:

- o Retrofitting one-half of the 116,500 schools and co Nation. Measures would include installing weather caulking, insulation and double-glazed windows.

- o Retrofitting one-half of the 6,000 non-Federal, nor hospitals in the United States (measures are same a

- o Retrofitting all of the 403,000 Federal buildings ( are same as above).

- o Weatherizing 1.35 million homes occupied by low-inc The program would be run by state and local governm

- o Weatherizing 50,000 HUD-owned single-family homes a solar water heaters in 10,000 of these homes.

- o Constructing 4,000 miles of bikeways for which fun are already pending.

(7) Table A-17. The Environmental Protection Agency's Act is an excellent "how to manage" manual for communities prospect of accelerated growth. Volume I provides wo estimating peak employment and population projections types of energy development activities. The portions calculating direct employment effects are presented i

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*The FEA analyses are summarized by S. Lynn Sutcliff and Allan Senate Commerce Committee memorandum submitted to the Carter Tr (December 14, 1976).

**The Action Handbook (EPA 9081/4-78-005a) is available, free o Joel Webster, EPA, Region 8, 1860 Lincoln Street, Denver, Color 303/837-4904.

summarizes the wage rates for technical, nontechnical and manua
by energy facility. Table A-19 presents total construction mar
costs, calculated as the products of the hourly rates in table
and the original man-hour estimates from ESPM. Descriptions of
energy facilities included in ESPM are available in:

Resource Requirements: Impacts and Potential Constraints Associated with Various Energy Facilities. Research and Engineering, Bechtel National, Inc. (San Francisco, August 1978) Appendix B.

(9) Table A-20. This table summarizes the direct labor requirement for a 4 MWe wind turbine generator, as estimated in a Lockhead Aircraft mission analysis for ERDA.***

In addition to the studies mentioned above, a forthcoming book Steve H. Murdock and Larry Leistritz summarizes the direct empl requirements and indirect employment multipliers for typical We energy resource development projects:

Energy Development in the Western United States: Impact on Rural Areas. New York: Praeger Publishers, 1979 (in press).

Contact: Larry Leistritz
Department of Agricultural Economics
Texas A&M University
College Station, Texas 77843
713/845-2333.

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scalation in the Costs of Manpower, Materials and Equipment Needed for cilities. Research and Engineering, Bechtel Corporation (San Francisc tober 1977) PAE-3794-F.

See section 3, part 1 for a description of the ESPM data base.

**Lockhead Aircraft Corporation, Wind Mission Analysis Study for ERDA, eport. LR-27611, 1976. A summary of these results are published in: gh Potential of Wind as an Energy Resource." U. Coty and M. Dubey. L California Company, Second Annual Energy Symposium, Los Angeles Counci gineers and Scientists, May 19, 1976.

| Type of System | Low | Mid | High |
|---|---|---|---|
| Hot Water | 0.55 | 0.76 | 1.0 |
| Hot Water, Space Heat | 0.45 | 0.55 | 0.64 |
| Hot Water, Space Heat, Space Cooling | 0.68 | 0.79 | 1.1 |
| | Direct Employee Hours per MMBtu/year (on an actual energy output basis per year of system operation)[b] | | |
| Hot Water | 2.04 | 2.81 | 3.70 |
| Hot Water, Space Hest | 3.46 | 4.23 | 4.92 |
| Hot Water, Space Heat, Space Cooling | 4.25 | 4.94 | 6.88 |

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[a]Direct employment here includes collector manufacturing, system installation and maintenance. It does not include component manu

[b]Calculations are based on the following estimates of heat output foot of collector: Hot Water, 0.27 MMBtu (actual)/$ft^2$; Space Hea 0.13 MMBtu (actual)/$ft^2$; and Space Heat/Space Cooling/Hot Water, (actual)/$ft^2$.

$$eh/MMBtu/year = \frac{eh}{ft^2} \times \frac{ft^2}{MMBtu}$$

Virginia: MITRE Corporation, MITRE Working Paper No. 12569 (Septe

arles G., et al., Assessment of Need for Developing and Implementin
al and Skilled Worker for the Solar Energy Industry, Final Report,
na, Texas: Navarro College (DOE No. EG 77-S-104-3869 (January 13,

eve and Fred Branfman, Job from the Sun; Employment Development
California Solar Energy Industry, Los Angeles, California: Californ
Policy Center (February 1978).

n, Keith Armington, Direct Labor Requirements for Select Energy
ogies: A Review and Synthesis. SERI Working Paper, August 1978.

acts of Solar Energy Development, Report to the Impacts Panel by th
ent Impacts Task Force, Advanced Energy Systems Policy Division, U.
ent of Energy, September 1978.

| System | Direct Labor | Indirect Labor | Total |
|---|---|---|---|
| Passive | 1.70 | 2.60 | 4.30 |
| Hot Water | 2.81 | 5.62 | 8.43 |
| Hot Water, Space Heat | 4.23 | 8.46 | 12.69 |
| Hot Water, Space Heat, Space Cooling | 4.94 | 9.88 | 14.82 |

SOURCES: Estimates for passive are based on assumptions used by th
Impacts Task Force, Labor Impacts of Solar Energy Develop
Domestic Policy Review of Solar, Advanced Energy Systems
Division, USDOE. September 21, 1978, p. 9.

Estimates for flat-plate collector systems are based on
(direct) and independent input-output estimates from BLS
Herendeen, Center for Advanced Computation, University of
(see Task Force Report cited above).

| e | Technology | Demand Type | Capacity MW | Capacity Factor | MY/KW | MHR/MMBtu/yr. (Actual) | Costs $/MMBtu | Cost $/MMBt |
|---|---|---|---|---|---|---|---|---|
| | Solar Thermal Central Receiver, 3-hour storage | Semi Peak | 100 | 0.35 | 0.013 | 2.32 | 31.93 | 22.26 |
| | Solar Thermal Central Receiver, 6-hour storage | Semi Peak | 100 | 0.50 | 0.017 | 2.12 | 32.69 | 23.84 |
| | Solar Thermal Central Receiver | Fuel Saver | 100 | 0.30 | 0.010 | 2.09 | 32.69 | 24.00 |
| | PV with Storage Collector/Reflector 16% Silicon | Semi Peak | 100 | 0.30 | 0.025 | 4.25 | 44.33 | 26.57 |
| | PV with Storage Collector/Reflector 10% Thin Film | Semi Peak | 100 | 0.30 | 0.041 | 3.33 | 34.82 | 20.85 |
| | PV with Storage Collector/Reflector 16% Silicon | Intermed. | 100 | 0.45 | 0.04 | 4.62 | 48.20 | 28.96 |
| | PV with Storage Collector/Reflector 10% Thin Film | Intermed. | 100 | 0.45 | 0.067 | 3.96 | 38.56 | 23.12 |

: All estimates are in terms of actual energy output. In order to convert these date to a MMBt oil displaced basis, all estimates would be divided by three (i.e., 1 Btu produced at the poi the equivalent of 3 Btu input in the form of primary energy, following the rule for electrici that it takes 10,400 Btu of primary energy to generate 1 kWh of electricity, versus the actua of 3,413 Btu per kWh).

TABLE A-3 (continued)

| Technology | Demand Type | Plant Capacity MW | Capacity Factor | Direct Labor: Fabrication/Shipping/Install MY/KW | MHR/MMBtu/yr. (Actual) | Capital Costs $/MMBtu | Material Costs $/MMBtu |
|---|---|---|---|---|---|---|---|
| PV with Storage 10X Concentration/ Verticle Tracking | Intermed. | 100 | 0.45 | 0.045 | 6.33 | 65.86 | 39.44 |
| PV Collector/ Reflector 16% Silicon | Fuel Saver | 100 | 0.28 | 0.017 | 3.21 | 33.43 | 20.02 |
| PV Collector/ Reflector 10% Thin Flim | Fuel Saver | 100 | 0.26 | 0.027 | 2.43 | 25.46 | 15.24 |
| PV 10XCFC/ 16% Silicon | Fuel Saver | 100 | 0.30 | 0.035 | 6.06 | 63.17 | 37.89 |
| WECS with Hydro-Electric Hybrid | Intermed. | 100 | 0.48 18 mph | 0.0054* | 0.705 | 17.96 | 15.02 |
| Advanced WECS with Gas Turbine | Intermed. | 100 | 0.49 14 mph | 0.0050* | 0.678 | 21.08 | 18.26 |
| Advanced WECS with Combined Cycle | Baseload | 100 | 0.87 18 mph | 0.0085* | 0.612 | 13.58 | 11.03 |
| WECS | Fuel Saver | 1.5 22.4 mph | 0.30 | 0.0051* | 1.065 | 23.02 | 18.58 |

TABLE A-3 (continued)

| ogy | Demand Type | Plant Capacity MW | Capacity Factor | Direct Labor: Fabrication/Shipping/Install MY/KW | MHR/MMBtu/yr. (Actual) | Capital Costs $/MMBtu | Material Costs $/MMBtu | Indirec Labor MHR/MMBt (Actual |
|---|---|---|---|---|---|---|---|---|
| d WECS | Fuel Saver | 1.5<br>17.1 mph | 0.65 | 0.0085 | 0.619 | 14.04 | 10.63 | 0.89 |
| red Steam | Intermed. | 100 | 0.05 | 0.007 | 0.676 | 17.05 | 13.25 | 1.12 |
| red Steam | Baseload | 100 | 0.80 | 0.008 | 0.627 | 10.65 | 8.04 | 0.67 |
| eated Processing | | 68,750 MMBtu | | | 0.990 | 8.73 | 9.00 | 0.50 |
| Hot Air ryer | | 70,200 MMBtu | | | 0.657 | 9.85 | 7.11 | 0.59 |
| Hot Water hing System | | 38,250 MMBtu | | | 0.561 | 9.22 | 6.88 | 0.57 |
| ° Hot Air Curing | | 29,565 MMBtu | | | 2.010 | 26.48 | 15.89 | 1.33 |
| ectric dam erplant | Baseload | 0.981 x $10^9$ kWh | | | 0.702 | 8.46 | 4.93 | 0.41 |
| plant | Baseload | 264.5 | 0.61 | | 2.622 | | | 1.67 |
| plants | Baseload | | 0.61 | | 2.001 | | | 1.13 |

TABLE A-3 (continued)

| ce | Technology | Demand Type | Plant Capacity MW | Capacity Factor | Direct Labor: Fabrication/Shipping/Install MY/KW | MHR/MMBtu/yr. (Actual) | Capital Costs $/MMBtu | Materi Cost $/MMBt |
|---|---|---|---|---|---|---|---|---|
| | OTEC 7 plants | Baseload | 264.5 | 0.61 | | 1.535 | | |
| | Biomass-Methanol | | 3.82 x $10^6$ MMBtu | | | 0.405 | 4.23 | |
| | Biomass-Medium Btu Gas | | 6.34 x $10^6$ MMBtu | | | 0.099 | 1.03 | 0.62 |
| | Biomass-Substitute Natural Gas | | 5.58 x $10^6$ MMBtu | | | 0.198 | 2.09 | 1.25 |
| | Biomass-Process Heat 850 ton/day | Steam | 3.86 x $10^6$ MMBtu | | | 0.192 | 2.01 | 1.20 |
| | 1,700 ton/day | Steam | 8.40 x $10^6$ MMBtu | | | 0.135 | 1.43 | 0.88 |
| | 3,400 ton/day | Steam | 17.64 x $10^6$ MMBtu | | | 0.105 | 1.09 | 0.66 |

TABLE A-3 (continued)

TE: Unit labor estimates computed from data presentes in:

-- Systems Description and Engineering Costs for Solar-Related Technologies, Volume I, Summary MITRE Corporation, Metrek Division, June 1977.

— Systems Description and Engineering Costs for Solar-Related Technologies, Volume III, Agric and Industrial Process Heat. The MITRE Corporation, Metrek Division, June 1977.

— Escalation in the Costs of Manpower, Materials, and Equipment Needed for Energy Facilities, Corporation, October 1977. Resource Requirements, Impacts, and Potential Constraints Assoc Various Energy Futures. Bechtel National, Inc., March 1978.

— Systems Descriptions and Engineering Costs for Solar-Related Technologies, Volume VII, Ocea Energy Conversion. The MITRE Corporation, Metrek Division, June 1977.

— Systems Description and Engineering Costs for Solar-Related Technologies, Volume IX, Biomas Production and Conversion System. The MITRE Corporation, Metrek Division, June 1977.

| Region, Size and Type of Coal | Personnel | | |
|---|---|---|---|
| | Production | Maintenance | Supervision |
| Eastern (Bituminous) | | | |
| 1MM | 37 | 22 | 18 |
| 3MM | 63 | 38 | 28 |
| 5MM | 100* | 54 | 24 |
| Interior (Bituminous) | | | |
| 1MM | 40 | 23 | 15 |
| 1MM | 36 | 23 | 16 |
| 1MM | 57 | 18 | 18 |
| 3MM | 68 | 29 | 15 |
| 6.7MM | 106* | 54 | 24 |
| N. Great Plains (Subbituminous) | | | |
| 1MM | 27 | 11 | 9 |
| 5MM | 66 | 18 | 11 |
| 5MM | 53 | 22 | 14 |
| 9.2MM | 126* | 63 | 24 |
| Southwest (Lignite) | | | |
| 1MM | 29 | 11 | 9 |
| 5MM | 74 | 32 | 17 |

*Production figures include reclamation and road building.

SOURCE: Basic Estimated Capital Investment and Operating Costs fo Strip Mines, U.S. Department of Interior, Bureau of Mines Circulars 8661 (1975) and 8703 (1976).

Note: All mines were assumed to have a 20-year life. The Argon compared BOM data with two other sets of data on employme mines (A-5 and A-6). The Argonne atudy concludes that "T ment picture understates the actual mine performances ... to 33 percent, depending on the size of mine. The user must be aware of the probable underestimation that strict these figures involves."

| | | | | |
|---|---|---|---|---|
| am | | | | |
| | 202 | 11 | 44 | 257 |
| | 390 | 15 | 59 | 464 |
| | 585 | 18 | 74 | 677 |
| am | | | | |
| | 192 | 11 | 43 | 246 |
| | 357 | 15 | 56 | 428 |
| | 544 | 18 | 71 | 633 |

: Basic Estimated Capital Investment and Operating Costs for Undergro Bituminous Coal Mines, U.S. Department of Interior, Bureau of Mines Information Ciculars 8689 (1975) snd 8682A (1976).

All mines were assumed to have a 20-year life.

| Location | Technique | Tons/Year | Manpower | Seams |
|---|---|---|---|---|
| E. Kentucky | multi-pit | 1.75M | 200 | 18",22",40 |
| Tennessee | contour & multi-pit | .35M | 85 | 65",54",27 24" |
| West Virginia | modified block cut | .085M | 14 | 17" |
| Pennsylvania | "typical dragline" "previous stripping of outcroppings" | .5M | 33* | 42" |
| W. Pennsylvania | "previous contour stripping" | .12M | 24 | 24-28" |
| W. Pennsylvania | "family type of organization" | .24M | 19 | 48-60" |
| Ohio | 1 of 8 active pits | .6M | 99 | 47" |
| Ohio | modified area technique | .14M | 38 | 34" |
| S. Illinois | | .3M | 157 | 5',3.5' (2 pits) |
| S. Indiana | "typical Midwest mine" | .144M | 157 | 54" |
| Colorado | large corporate structure, "traditional technique" | 1.8M | 99 | 7-10', 4' (2 pits) |

*Some contracting of work.

| | | | | |
|---|---|---|---|---|
| oming | 3M | 102 | 3-20′ | "geologic structure very complex" |
| tana | 5M | 162 | 52" | unknown |
| kota | 2M | 70 | 20′ (total for 3 pits) | 60′ |

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Economic Engineering Analysis of U.S. Surface Coal Mines, Skelly & Loy Consultants, 1975; chapter 9, pp. 1-186.

| Location | Output | Manpower | Width of Seams |
|---|---|---|---|
| Eastern | .73MM | 62 | 3′,8′ (two pi |
| Midwest | 1.45MM | 166 | 45′ |
| Northern Great Plains | 3.30MM | 137 | 24′,8.5′ (two |
| Southwest | 7.00MM | 454 | unknown |

SOURCE: Operation Study of Selected Surface Coal Mining Systems United States, Theodore Barry and Associates, NTIS PB-24 1975.

| elop-nt | Support Services | Plat-forms | Pipeline Terminals | Gas Processing Plants | Office | Opera-tions Base | Construc-tion | Plat-form Construc-tion Facility | Total[a] | Tot |
|---|---|---|---|---|---|---|---|---|---|---|
| | 58 | | | | | | 40 | | 263 | 26 |
| | 58 | | | | | | | 120 | 343 | 34 |
| | 58 | | | | | | | 347 | 735 | 73 |
| | 58 | | | | | | 40 | 345 | 1103 | 110 |
| 95 | 116 | 16 | | | | | 40 | 345 | 1372 | 137 |
| 5 | 116 | 48 | | | | | 397 | 365 | 2041 | 204 |
| 15 | 174 | 112 | | | 14 | 45 | 467 | 363 | 2715 | 271 |
| 5 | 232 | 160 | 17 | 34 | 14 | 45 | 40 | 390 | 2602 | 260 |
| 5 | 232 | 240 | 17 | 34 | 14 | 45 | | 419 | 2766 | 276 |
| 0 | 290 | 320 | 17 | 34 | 14 | 45 | 207 | 452 | 3339 | 333 |
| 55 | 348 | 848 | 34 | 68 | 45 | 145 | 367 | 500 | 4285 | 428 |
| | 58 | 960 | 51 | 102 | 77 | 250 | | (500 | 2163) | 166 |
| | 58 | 848 | 51 | 68 | 67 | 218 | | (500 | 1975) | 147 |
| | 58 | 400 | 17 | 34 | 31 | 100 | | (500 | 1305) | 80 |

cility continues construction after year 16 for other areas.

atform contruction ceases after year 16.

rom calculations by Woodward-Clyde Consultants, Mid-Atlantic Regional Study, Table 2-2.

med that the productive life of the oil and gas fiels was 22 years, with 8 years of exporation at. The Argonne study recognizes that "further development is, of course, a possibility, if new finds are made. Users of the employment projections must be award of this possibility they are of the small probability that nothing will be recovered beneath the seas."

TABLE A-9: CONSTRUCTION AND OPERATION MANPOWER REQUIREMENTS FOR SELECTED NUCLEAR POWERPLANTS, BY YEAR

| | BELLEFONTE[a] | | MC GUIRE[b] | | RIVER BEND[c] | | SUSQUEHANNA[d] | | HYPOTHETICA AVERAGE | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Alabama | | North Carolina | | Louisiana | | Pennsylvania | | — | |
| | 2430 | | 2360 | | 1870 | | 2100 | | 2200 | |
| on Employment | 2240 | | 1810 | | 2200 | | 2500 | | 2080 | |
| | 170 | | 200 | | 100 | | 77 | | 140 | |
| | Construc-tion Employ-Ment | Opera-tion Employ-Ment | Construc-tion Employ-Ment | Opera-tion Employ-Ment | Construc-tion Employ-Ment | Opera-tion Employ-Ment | Construc-tion Employ-Ment | Opera-tion Employ-Ment | Construc-tion Employ-Ment | Op |
| | 850 | 0 | 850 | 0 | 100 | 0 | 300 | 0 | 395 | |
| | 1500 | 0 | 1537 | 0 | 350 | 0 | 1800 | 0 | 1164 | |
| | 2150 | 0 | 1810 | 0 | 1200 | 0 | 2300 | 0 | 1872 | |
| | 2240 | 30 | 1654 | 0 | 2100 | 0 | 2500 | 0 | 2080 | |
| | 1660 | 155 | 950 | 30 | 2000 | 0 | 2400 | 0 | 1810 | |
| | 630 | 170 | 200 | 170 | 1650 | 0 | 1500 | 0 | 1221 | |
| | 0 | 170 | 0 | 200 | 1000 | 30 | 800 | 0 | 479 | |
| | 0 | 170 | 0 | 200 | 300 | 70 | 250 | 20 | 0 | |
| | 0 | 170 | 0 | 200 | 0 | 100 | 100 | 60 | 0 | |
| | 0 | 170 | 0 | 200 | 0 | 100 | 0 | 77 | 0 | |
| | 0 | 170 | 0 | 200 | 0 | 100 | 0 | 77 | 0 | |
| | 0 | 170 | 0 | 200 | 0 | 100 | 0 | 77 | 0 | |

reliminary Safety Analysis Report, Bellafonte Nuclear Plant, Tennessee Valley Authority.
nvironmental Report, Operating License Stage, William B. McGuire Station, Units 1 & 2, Duke Power Company.
nvironmental Report, Construction Permits Stage, River Bend Units 1 and 2, Gulf States Utilities Company.

COAL-FIRED ELECTRIC GENERATING PLANTS, BY YEAR

| | Colstrip 3 & 4[a] | | Tombigbee 2 & 3[b] | | Kaiparowits (4 Units)[c] | | Jim Bridger (2 Units)[d] | | Bechtel - Lo[e] | | Bechte |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Montana | | Alabama | | Utah | | Wyoming | | — | | - |
| | 700 | | 420 | | 3000 | | 500 | | 800 | | 80 |
| | No | | No | | Yes | | Yes | | No | | No |
| n | 1750 | | 1200 | | 3105 | | 3000 | | 2850-4071 | | 2400- |
| | 693 | | 450 | | 3135 | | 282 | | 125 | | 10 |
| ac- - | Operations Employment | Construction Employment | Operations Employment | Construction Employment | Operations Employment | Construction Employment | Operations Employment | Construction Employment | Operations Employment | Construction Employment | O t E |
| | 0 | 180 | 0 | 466 | 0 | 450 | 0 | 90 | 0 | 77 | |
| | 0 | 972 | 0 | 2515 | 0 | 2430 | 0 | 956 | 0 | 806 | |
| | 0 | 972 | 0 | 2515 | 0 | 2430 | 0 | 1972 | 0 | 1661 | |
| | 173 | 180 | 112 | 466 | 783 | 450 | 70 | 1861 | 0 | 1565 | |
| | 693 | 0 | 450 | 0 | 3135 | 0 | 282 | 821 | 31 | 691 | |
| | 693 | 0 | 450 | 0 | 3135 | 0 | 282 | 0 | 125 | 0 | |
| | 693 | 0 | 450 | 0 | 3135 | 0 | 282 | 0 | 125 | 0 | |
| | 693 | 0 | 450 | 0 | 3135 | 0 | 282 | 0 | 125 | 0 | |
| | 693 | 0 | 450 | 0 | 3135 | 0 | 282 | 0 | 125 | 0 | |

raft Environmental Impact Satement for Colstrip Electric Generating Units 3 and 4, Energy Planning Division, Mon tate Department of Natural Resouces and Construction, Helena, Montana, November 1974, Vol. 3-A, p. 181.

n Environmental Analysis, Tombigbee Power Plant Site, Leroy, Alabama, Burns and McDonnell, Kansas City, Mo., 197 . B-51, 52.

nvironmental Impact Statement, Kaiparowits Project, Bureau of Land Management, Department of the Interior. March

raft Environmental Impact Statement for Jim Bridger Power Plant.

he Energy Supply Planning Model, Bechtel Corporation, NTIS PB-245382, August 1975.

TABLE A-11: CONSTRUCTION AND OPERATION MANPOWER REQUIREMENTS FOR OIL-SHALE CONVERSION PROCESSES, BY YEAR

| | Project Independence[a] | | | | EIS Prototype[b] | | | | Bechtel[c] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface | | In-Situ | | Surface | | In-Situ | | Surface | | |
| | Construction Employment | Operations Employment | Construction Employment | Operations Employment | Construction Employment | Operations Employment | Construction Employment | Operations Employment | Construction Employment | Operations Employment | Con tio Emp me |
| | 678 | 0 | 914 | 0 | 1470 | 0 | 1240 | 0 | 1376 | 0 | 82 |
| | 1220-1470 | 0 | 1827 | 0 | 1470 | 0 | 1240 | 0 | 4121 | 0 | 331 |
| | 678 | 277 | 914 | 289 | 1470 | 323 | 1240 | 359 | 5963 | 0 | 501 |
| | 0 | 1110 | 0 | 1158 | 0 | 1293 | 1240 | 1435 | 5040 | 385 | 448 |
| | 0 | 1110 | 0 | 1158 | 0 | 1293 | 1240 | 1435 | 4485 | 1138 | 374 |
| | 0 | 1110 | 0 | 1158 | 0 | 1293 | 1240 | 1435 | 0 | 1138 | |
| | 0 | 1110 | 0 | 1158 | 0 | 1293 | 1240 | 1435 | 0 | 1138 | |
| | 0 | 1110 | 0 | 1158 | 0 | 1293 | 1240 | 1435 | 0 | 1138 | |

: (a) Interagency Task Force on Oil Shale, Federal Energy Administration, Project Independence Blueprint Fina Washington, D.C., November 1974, quoted in Synthetic Fuels Commercialization Program, Draft Environment Statement, Washington, D.C., November 1975.

(b) EIS for the Prototype Oil Shale Leasing Program, U.S. Department of Interior, Vol. I, pp. III-247 and 2

(c) The Energy Supply Planning Model, Bechtel Corporation, NTIS PB-245382, 1975.

TABLE A-12: CONSTRUCTION AND MANPOWER REQUIREMENTS FOR COAL GASIFICATION, BY YEAR

| FEA-HI[a] | | FEA-LO[a] | | WESCO[b] | | EL PASO[c] | | MICHWIS[d] | NATIONAL |
|---|---|---|---|---|---|---|---|---|---|
| uc- - | Operations Employment | Construction Employment | Operations Employment | Construction Employment | Operations Employment | Construction Employment | Operations Employment | Operations Employment | Operatio Employme |
| 0 | | 68 | 0 | 2050 | 0 | 330 | 0 | 0 | 0 |
| 0 | | 157 | 45 | 3450 | 0 | 1998 | 33 | 0 | 0 |
| 223 | | 197 | 181 | 4300 | 153 | 3617 | 586 | 1026 | 231 |
| 891 | | 0 | 181 | 3450 | 612 | 2056 | 1234 | 1539 | 925 |
| 891 | | 0 | 181 | 4300 | 612 | 3296 | 1806 | 2052 | 925 |
| 891 | | 0 | 181 | 3450 | 612 | 1757 | 2628 | 2565 | 925 |
| 891 | | 0 | 181 | 4300 | 612 | 294 | 3009 | 3078 | 925 |
| E91 | | 0 | 181 | 3450 | 612 | 0 | 3009 | 3591 | 925 |
| 891 | | 0 | 181 | 2050 | 612 | 0 | 3009 | 4104 | 925 |
| 891 | | 0 | 181 | 0 | 612 | 0 | 3009 | 4104 | 925 |
| 891 | | 0 | 181 | 0 | 612 | 0 | 3009 | 4104 | 925 |
| 891 | | 0 | 181 | 0 | 612 | 0 | 3009 | 4104 | 925 |

nteragency Task Force on Synthetic Fuels from Coal, Federal Energy Administration Project Independence Blueprint inal Task Force Report, Washington, D.C., November 1974.

raft Environmental Statement, WESCO Complex, Department of Interior Bureau of Reclamation, 1-74; pages I-66 and -71.

raft Environmental Statement, El Paso Gasification Project, chapter 3, table 3-11, page 54.

oal and Water for Future Gasification, Michigan-Wisconsin Pipe Line Company, February 1973, section II, page 6.

ummary Description, Ounn Center Coal Gasification Project, National Gas Pipeline Company, 1975.

| Years | Fischer-Tropsch[a] | | Direct[a] | | Bechtel- |
|---|---|---|---|---|---|
| | Construc-tion Employ-ment | Opera-tions Employ-ment | Construc-tion Employ-ment | Opera-tions Employ-ment | Construc-tion Employ-ment |
| 1 | 283 | 0 | 286 | 0 | 200 |
| 2 | 495 | 0 | 569 | 0 | 1200 |
| 3 | 510 | 0 | 569 | 0 | 2100 |
| 4 | 758 | 148 | 490 | 138 | 2300 |
| 5 | 191 | 593 | 186 | 554 | 1200 |
| 6 | 0 | 593 | 0 | 554 | 0 |
| 7 | 0 | 593 | 0 | 554 | 0 |
| 8 | 0 | 593 | 0 | 554 | 0 |
| 9 | 0 | 593 | 0 | 554 | 0 |
| 10 | 0 | 593 | 0 | 554 | 0 |
| 20 | 0 | 593 | 0 | 554 | 0 |
| 30 | 0 | 593 | 0 | 554 | 0 |

SOURCES: (a) Interagency Task Force on Synthetic Fuels from Co
Energy Administration Project Independence Bluepr
Force Report.

(b) Bechtel Energy Supply Planning Model.

| Location | GEYSERS[a] | IMPERIAL VALLEY[b] | BECHTEL[c] |
|---|---|---|---|
| Output | 110 MWe | 135 MWe | 200 MWe |
| Number of Wells | 12-20 | 20-30 | Undetermined |
| Peak Construction | 30 | 80 | 374 |
| Operations | 81 | 10 | 83 |

| Years | Construction Employment | Operations Employment | Construction Employment | Operations Employment | Construction Employment | Operation Employment |
|---|---|---|---|---|---|---|
| 1 | 20 | 0 | 40 | 0 | 126 | 0 |
| 2 | 20 | 20 | 80 | 10 | 374 | 0 |
| 3 | 0 | 81 | 40 | 10 | 265 | 21 |
| 4 | 0 | 81 | 0 | 10 | 228 | 60 |
| 5 | 0 | 81 | 0 | 10 | 0 | 83 |
| 10 | 0 | 81 | 0 | 10 | 0 | 83 |
| 20 | 0 | 81 | 0 | 10 | 0 | 83 |
| 30 | 0 | 81 | 0 | 10 | 0 | 83 |

SOURCES: (a) Conversation with Union Oil representative.

(b) Conversation with Pacific Gas & Electric Company representative.

(c) Energy Supply Planning Model, Bechtel Corporation.

Note: Construction data for Geysers and Imperial Valley does not include the well digging, normally done on a contractual basis and employing approximately 75 people per well. It is also unclear whether or not Bechtel

| | Type of Insulation | |
|---|---|---|
| | Mineral Wool | Cellulose |
| | (person-yr. 1 ft.$^2$) | (person-yr. 1 |
| Manufacture--Total | (8.430 + 7.306 X**) x $10^{-7}$ | 5.090 x |
| direct | - | 3.1124 x |
| indirect | - | 1.9776 x |
| Tranaportation and Sale--Total | (1.059 + 0.918 X) x $10^{-7}$ | 3.101 x 1 |
| Installation (direct only) | 1/(352,500 - 7,833 X*) | 1.120 x 1 |
| TOTALS | | 1.939 x 1 |

*Includes labor requirements for the chemical inputs and for collecti
the newspaper.

**X = batt thickness in inches.

SOURCE: Labor and Net Energy Effects of a National Ceiling Insulatio
Program by Charlotte Ford, Center for Advanced Computation,
University of Illinois, Urbana-Champaign. (September 1978)

TABLE A-16: COSTS, DIRECT EMPLOYMENT AND ENERGY SAVINGS OF SIX ENERGY CONSERVATION PUBLIC WORKS PROGRAMS

| Program | Costs (million 1976 $) | DIRECT JOBS CREATED(a) Unskilled | Skilled(b) | Manuf. | Construction | Tot |
|---|---|---|---|---|---|---|
| Retrofit Public Schools & Colleges | 290 | 16,500 | 1,500 | 2,000 | - | 20,0 |
| Retrofit Hospitals | 150 | 9,000 | 1,000 | 1,250 | - | 11,2 |
| Retrofit Federal Buildings | 250 | 15,000 | 1,000 | 2,000 | - | 18,0 |
| Low-Income Weatherization | 770 | 27,000 | 5,400 | 10,000 | - | 42,4 |
| Weatherization & Installation of Solar Water Heaters in HUD Housing | 42 | 2,100 | 200(c) | 250(c) | - | 2,5 |
| Bike Path Construction | 140 | 5,000 | 500 | 770 | - | 6,2 |
| TOTAL | 1,642 | 74,600 | 9,600 | 16,270 | - | 100,4 |

SOURCE: Senate Commerce Committee memorandum by S. Lynn Sutchffe and Alan R. Hoffman t Transition Group (December 14, 1976).

Supervisors or carpenters (in the case of retrofits).

Since contracted labor is used to repair HUD-owned homes, public service employees may partially replace local labor.

Assumptions

- For most buildings, while a retrofit investment of $1 per square foot is propably cost effective (i.e., energy savings would repay the retrofit cost on a reasonable time scale), the most labor-intensive retrofit measures are associated with the first $0.10 of investment per square foot.

- Of every $3 spent on building retrofit, $2 goes for labor and $1 goes for materials (based on the labor/materials cost split characteristic renovation activities).

- Each unskilled or semi-skilled public service worker will receive $10,000 annually.

- Each skilled public service worker acting in a supervisory role will receive $15,000 annually.

- Each $40,000 of investment in materials will create one job in the manufacturing industry (this figure is an average of several industri and is also the figure specifically applicable to the insulation industry).

| | | |
|---|---|---|
| Strip Mining: | | |
| k employment per 1 million tons/year output | 17.5[2] | 66[3] |
| Underground Mining: | | |
| k employment per 1 million tons/year output | 138[4] | 345[3] |
| ric Powerplant:[3] | | |
| al fired, hydropower, nuclear) k employment per 1,000 megawatts capacity | 1,000 | 130 |
| hale Mining and Processing:[5] | | |
| k employment per 1,000 barrels/day output | 33 | 18 |
| um Mining and Milling:[6] | | |
| k employment per 100 tons uranium centrate produced/day | 13 | 22 |
| Gasification Plant:[3] | | |
| k employment per million cubic feet/day acity | 4.5 | 2.4 |

[1]These figures are estimates based on various actual experien
vary among energy facilities.

[2]Adopted from A Study of Social, Economic and Public Effects
Mines, Bickert, Browne and Coddington, 1976.

[3]Projects to Expand Fuel Sources in Western States, Bureau of

[4]Adopted from Baseline Environmental Report, Proposed, Long C
Mine, Dames and Moore, 1976.

[5]Oil Shale and the Future of a Region, Colorado Weat Area Cou
Governments, 1974.

[6]Draft Environmental Statement, Bear Creek Project, Rocky Mou
Company, 1976.

*Note: Large facilities may, becauae of economies of scale,
workers per unit of output than smaller facilities.

| Numbers | March 1977 Dollars Per Man-Hour Technical | Nontechnical | Manual |
|---|---|---|---|
| North Alaskan Wells) | 41.72 | 30.17 | 35.77 |
| Alaskan Pipelines) | 35.92 | 24.13 | 23.85 |
| (Alaskan Export) | 22.75 | 18.10 | 20.27 |
| (Solar) | 21.55 | 9.65 | 16.69 |
| , 4, 10, 12, 13, 20, 21, 23, 25, -1, 6, 7, 8, 12, 13, 14, 17, 18 Gas Extraction and Handling) | 20.95 | 15.08 | 17.89 |
| , 9, 17, 18, 31, 32, 33, 34, 35, rough 49 (Processing) | 17.96 | 8.45 | 14.31 |
| ugh 69 and T-9 (Railroad, Generation) | 14.37 | 8.45 | 15.50 |
| 16, 27, 28, 29, 30, 37 through g) | 14.37 | 7.24 | 13.71 |
| ugh 27 (Electrical Transmission ibution) | 12.81 | 9.65 | 15.50 |
| , 10, 11, 15, 16, 20 (Mobile s) | None* | None* | None* |

tles of the groups are resultant identifiers of how the rates happe
ut. They were not preselected categories.

presents total construction manpower costs, calculated as the prod
rly rates above and the original man-hour estimates.

---

acilities (e.g., trucks) are purchased directly and not built
ergy construction industry.

Escalation in the Cost of Manpower, Materials and Equipment Needed
Energy Facilities. Bechtel (1977).

| | | | | |
|---|---|---|---|---|
| E 1 | Onshore Primary Oil Recovery - Lower 48 | 1,676 | 226 | |
| E 2 | Onshore Secondary Oil Recovery - Lower 48 | 691 | 121 | |
| E 3 | Onshore Enhanced Oil Recovery - Lower 48 | 1,194 | 181 | |
| E 4 | Offshore Oil Recovery - Lower 48 and South Alaska | 5,762 | 905 | 1 |
| E 5 | North Alaskan Oil Recovery | 5,447 | 1,810 | 2 |
| E 6 | High-Gasoline Refinery | 48,487 | 5,406 | 16 |
| E 7 | Low-Gasoline Refinery | 43,099 | 4,645 | 14 |
| E 8 | Heavy Fuel Oil Gasification | 37,891 | 3,294 | 14 |
| E 9 | Naphtha Gasification | 8,081 | 1,224 | 3 |
| E10 | Crude Oil Stockpile | 5,866 | 1,056 | 3 |
| E11 | Alaskan Oil Export | 38,670 | 5,430 | 24 |
| E12 | Offshore Crude Oil Import | 10,685 | 2,564 | 3 |
| E13 | Onshore Oil Import | 7,542 | 1,961 | 2 |
| E14 | Surface Oil Shale Mine | 5,316 | 290 | 6 |
| E15 | Underground Oil Shale Mine | 12,283 | 652 | 3 |
| E16 | In-Situ Shale Oil Recovery | 8,476 | 471 | 2 |
| E17 | Oil Shale Retorting and Upgrading | 53,874 | 2,534 | 20 |
| E18 | Shale Oil Upgrading | 44,895 | 2,534 | 17 |
| E19 | Onshore Conventional Gas Recovery - Lower 48 | 3,352 | 453 | 1 |
| E20 | Onshore Enhanced Gas Recovery - Lower 48 | 14,666 | 2,639 | 7 |
| E21 | Offshore Gas Recovery - Lower 48 | 8,904 | 1,131 | 5 |
| E22 | North Alaskan Gas Recovery | 5,950 | 2,051 | 2 |
| E23 | Coal Mine Degasification | 105 | 15 | |
| E24 | Alaskan LNG Export | 93,262 | 18,099 | 45 |
| E25 | LNG Import | 28,284 | 6,033 | 14 |
| E26 | Nstural Gas Stockpile | 4,400 | 1,056 | 2 |
| E27 | Underground Eastern Coal Mine | 1,940 | 109 | |
| E28 | Surface Eastern Coal Mine | 3,003 | 232 | 1 |
| E29 | Surface Western Coal Mine | 3,649 | 268 | |
| E30 | Underground Western Coal Mine | 1,940 | 109 | |

| | | | | |
|---|---|---|---|---|
| Coal Gasification - High-Btu Gas | 66,445 | 3,379 | 237,526 | 30 |
| Coal Gasification - Low- and Medium-Btu Gas | 61,057 | 2,534 | 198,892 | 26 |
| Coal Gasification - Methanol | 77,219 | 14,359 | 286,176 | 37 |
| Coal Liquefaction - Heavy Fuel Oil | 26,937 | 4,223 | 71,544 | 10 |
| Coal Solvent Refining | 30,529 | 1,689 | 100,162 | 13 |
| Coal Liquids Refinery | 33,402 | 3,547 | 97,014 | 13 |
| Surface Uranium Mine | 1,049 | 43 | 6,212 | |
| Underground Uranium Mine | 632 | 22 | 1,934 | |
| Uranium Mill | 948 | 36 | 2,002 | |
| Uranium Conversion | 6,465 | 869 | 12,204 | 1 |
| Uranium Enrichment - Diffusion | 235,609 | 30,406 | 663,690 | 92 |
| LWR Fuel Fabrication - No Pu Recycle | 6,645 | 591 | 13,236 | 2 |
| LWR Fuel Fabrication - Pu Recycle | 5,621 | 304 | 12,349 | 1 |
| HTGR Fuel Fabrication | 20,293 | 1,436 | 52,513 | 7 |
| FBR Fuel Fabrication | 8,530 | 591 | 22,322 | 3 |
| LWR Spent Fuel Reprocessing | 67,702 | 4,983 | 169,702 | 24 |
| HTGR Spent Fuel Reprocessing | 16,701 | 1,183 | 41,496 | 5 |
| FBR Spent Fuel Reprocessing | 60,518 | 4,223 | 151,387 | 21 |
| High-Level Waste Disposal | 5,477 | 287 | 14,309 | 2 |
| Solid Waste Collection/Separation Plant | 280 | 21 | 1,118 | |
| Oil-Fired Powerplant | 7,758 | 2,196 | 55,804 | 6 |
| Reconversion of Oil Powerplant to Coal | 29 | 8 | 233 | |
| Coal-Fired Powerplant - Low-Btu Coal | 10,919 | 3,041 | 70,996 | 8 |
| Coal-Fired Powerplant - High-Btu Coal | 9,338 | 2,618 | 59,525 | 7 |
| Coal/Waste Powerplant - Low-Btu Coal | 10,631 | 1,351 | 31,002 | 4 |
| Coal/Waste Powerplant - High-Btu Coal | 9,769 | 1,014 | 26,352 | 3 |
| Sulfur Oxide Removal | 8,620 | 1,689 | 18,601 | 2 |
| Low/Intermediate-Btu Gas-Fired Plant | 6,178 | 1,689 | 43,403 | 5 |
| High-Btu Gas-Fired Powerplant | 5,603 | 1,439 | 34,103 | 4 |

| | | | | |
|---|---|---|---|---|
| E60 | Conversion of Gas Plant to Coal | 4,417 | 507 | |
| E61 | Combined Cycle Powerplant | 4,417 | 1,183 | |
| E62 | Gas Turbine Powerplant | 575 | 203 | |
| E63 | Fuel Cells | 106 | 41 | |
| E64 | Light Water Reactor | 35,916 | 10,980 | 1 |
| E65 | High-Temperature Gas Reactor | 53,156 | 18,582 | 1 |
| E66 | Fast Breeder Reactor - LMFBR | 45,973 | 10,980 | 1 |
| E67 | Dam and Hydroelectric Powerplant | 7,758 | 465 | |
| E68 | Pumped Storage | 21,119 | 1,351 | |
| E69 | Geothermal Power Complex | 2,715 | 228 | |
| E70 | Solar Space Heating | 18,964 | 6,660 | 1 |
| E71 | Solar Space Conditioning | 20,688 | 7,240 | 1 |
| T 1 | Crude Oil Pipeline - Lower 48 | 3,519 | 407 | |
| T 2 | Alaskan Oil Pipeline | 179,580 | 24,132 | 6 |
| T 3 | Oil Tanker | 0 | 0 | |
| T 4 | Oil Barge | 0 | 0 | |
| T 5 | Oil Tank Truck | 0 | 0 | |
| T 6 | Products Pipeline | 859 | 75 | |
| T 7 | Hot Oil Pipeline | 796 | 60 | |
| T 8 | Refined Products Bulk Station | 461 | 45 | |
| T 9 | Rail Line | 2,457 | 144 | |
| T10 | Mixed Train | 0 | 0 | |
| T11 | Coal Unit Train | 0 | 0 | |
| T12 | Coal Slurry Pipeline | 3,457 | 453 | |
| T13 | Coal Slurry Preparation | 2,828 | 603 | |
| T14 | Coal Slurry Dewatering | 1,990 | 151 | |
| T15 | Coal Barge | 0 | 0 | |
| T16 | Coal Truck | 0 | 0 | |
| T17 | Gas Pipeline - Lower 48 | 3,520 | 407 | |
| T18 | Gas Distribution Facilities | 2,242 | 196 | |
| T19 | Alaskan Gas Pipeline | 141,848 | 20,512 | 4 |
| T20 | LNG Tanker | 0 | 0 | |
| T21 | 230 kVac Transmission Line | 6,405 | 1,110 | |
| T22 | 345 kVac Transmission Line | 7,814 | 1,544 | |

| | | | |
|---|---|---|---|
| 500 kVac Transmission Line | 12,234 | 2,413 | 51,929 |
| 765 kVac Transmission Line | 15,116 | 2,992 | 70,840 |
| ± 400 kVdc Transmission Line | 12,938 | 2,317 | 55,339 |
| Electricity Distribution - Aerial Lines | 1,071 | 212 | 4,703 |
| Electricity Distribution - Underground Lines | 1,746 | 350 | 7,020 |

(1) Accuracy of information is seldom greater than three significant figures.

(2) May not add due to rounding.

Escalation in the Costs of Manpower, Materials and Equipment Needed for Energy Facilities. Bechtel (1977).

| Labor Category | Person-Hours | Perso |
|---|---|---|
| Manufacturing | 142,593 | |
| Onsite Labor | | |
| Site Preparation | 2,000 | |
| Transportation | 951 | |
| Assembly and Erection | 9,494 | |
| Foundation | 4,444 | |
| Onsite Subtotal | 16,889 | |
| Total | 159,482 | |

[a]Using 1,920 hours/person-year.

SOURCE: Lockheed Aircraft Corporation, Wind Mission Analysis St
ERDA (Draft Report, LR-27611, 1976).

t incorporate solar technologies and conservation measures into the I-O
mework. These include:

- Sector-Specific Output and Employment Impacts of a Solar Space and Heating Industry, by H. C. Peterson, Utah State University, Logan, (1977). This study augments the direct requirements matrix of the I-O table to include the purchase requirements of an industry whic manufactures solar collectors and one which installs complete sola space and water heating systems.

  Available from: National Technical Information Service (NTIS)
  U.S. Department of Commerce
  Springfield, Virginia 22161

- The Long Island Jobs Energy Study. Council on Economic Priorities (April 1979 FINAL DRAFT). This study develops a "bill of goods" for solar hot water systems, a nuclear powerplant and a variety of residential conservation measures. The bill of goods is identifie terms of SIC sectors, and can be readily applied to the BLS I-O an models.

  Contact: Steven Buchsbaum
  Council on Economic Priorities
  84 5th Avenue
  New York, New York 10011
  212/691-8550

- Labor and Net Energy Effects of a National Ceiling Insulation Prog by Charlotte Ford, Center for Advanced Computation, University of Illinois, Urbana, Illinois (September 1978). This study develops of goods for cellulose ceiling insulation (see appendix B).

  Contact: Charlotte Ford
  Center for Advanced Computation
  University of Illinois
  Urbana, Illinois 51801
  217/333-3242

solar syatems (hot water, hot water/space heating, hot water/spa heating/absorption cooling, and auxiliary). The bill of goods tailored to the national BLS I-O model.

Contact: Jerry Lawry
Science Applications, Inc.
JRB Associates
8400 Westpark Drive
McLean, Virginia 22102
202/821-4325

- Energy, Employment, and Environmental Impacts of Accelerated In in Conservation and Solar Technologies in Buildings. Steven C. Shirish Mulherkar, Jay Schwam, Department of Energy and Environ Brookhaven National Laboratory (PRELIMINARY REPORT, 1978). Thi develops a "bill of goods" for conservation and solar technolog residential/commercial buildings. The bill of goods is identif terma of BNL I-O Sectora.

Contact: David Kline
Project Moniter
U.S. Department of Energy
Room 2220
20 Massachusetts Avenue, NW.
Washington, D.C. 20545
202/376-4827

- Analysis of the California Energy Industry. Energy and Environ Division, Lawrence Berkeley Laboratory (January 1977). This st develops a bill of goods for passive solar housing construction additional insulation and double-glazed window units), delampin commercial buildinga, retrofit ceiling insulation, wind turbine rators, solar thermal electric powerplants, and systems to conv municipal solid waste to energy.

Contact: Jayant Sathaye
Lawrence Berkeley Laboratory
University of California
Berkeley, California
415/451-6292

1.

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U.S. Government Printing Office
Washington, D.C. 20402

(1) Tables C-1 and C-2 present the various energy supply and transportation facilities contained in the Bechtel Energy Supp Planning Model.

(2) Table C-3 presents the industrial groupings used in the Bureau Economic Anslysis REIS, with Standard Industrial Classificatio Codes (SIC).

(3) Table C-4 presents the sectoral classification of the BNL I-O and alignment with other classification systems. The attachme this table describes the energy sectors in greater detail.

(4) Table C-5 presents sector descriptions of the RIMS state/censu multipliers.

(5) Table C-6A presents the economic sectors of the REAP I-O model corresponding SIC codes.

(6) Tables C-6B to C-6D display the REAP project data for three ty of energy supply: export mine, electric plant and SNG plant.

(7) Table C-7 presents the sectoral classification of the BLS I-O with corresponding SIC groups, and projected 1985 employment c ratios.

(8) Table C-8 presents the economic sectors of the RSRI I-O model corresponding SIC codes.

(9) Table C-9 presents the sectoral classification of the INFORUM and corresponding SIC codes.

2. On-shore Secondary Oil Recovery
3. On-shore Enhanced Oil Recovery
4. Off-shore Oil Recovery
5. North Alaskan Oil Recovery
6. High-Gasoline Refinery
7. Low-Gasoline Refinery
8. Heavy Fuel Oil Gasification
9. Naphtha Gasification
10. Crude Oil Stockpile
11. Alaskan Oil Export
12. Off-shore Crude Oil Import
13. On-shore Oil Import
14. Surface Oil Shale Mine
15. Underground Oil Shale Mine
16. In SITU Shale Oil Recovery
17. Oil Shale Retorting and Upgrading
18. Shale Oil Upgrading

20. On-Shore Enhanced Gas Recover
21. Off-Shore Gas Recovery - Lowe
22. North Alaskan Gas Recovery
23. Coal Mine Degasification
24. Alaskan LNG Export
25. LNG Import
26. Natural Gas Stockpile

Coal

27. Underground Eastern Coal Mine
28. Surface Eastern Coal Mine
29. Surface Western Coal Mine
30. Underground Western Coal Mine
31. Coal Gasification - High Btu
32. Coal Gasification - Low and Medium Btu
33. Coal Gasification - Methanol
34. Coal Liquefaction - Heavy Fue
35. Coal Solvent Refining
36. Coal Liquids Refinery

3. Underground Uranium Mine

4. Uranium Mill

5. Uranium Conversion

6. Uranium Enrichment

7. Light Water Reactor Fuel Fabrication - without Plutonium Recycle

8. Light Water Reactor Fabrication - with Plutonium Recycle

9. High Temperature Gas Reactor Fuel Fabrication

10. Fast Breeder Reactor Fuel Fabrication

11. Light Water Reactor Spent Fuel Reprocessing

12. High Temperature Gas Reactor Spent Fuel Reprocessing

13. Fast Breeder Reactor Spent Fuel Reprocessing

19. High-Level Waste Disposal

20. Solid Waste Collection/ Separation Plant

52. High Temperature Reactor

53. Fast Breeder Reactor

Utilities

54. Oil-Fired Power Plant

55. Reconversion of Oil Plant to Co

56. Coal Fired Power Plant - Low Bt

57. Coal Fired Power Plant - High B

58. Coal/Waste Power Plant - Low Btu Coal

59. Coal/Waste Power Plant - High Btu Coal

60. Sulfur Oxide Removal

61. Low/Intermediate Btu Gas Fired Plant

62. High Btu Gas Fired Plant

63. Conversion of Gas Plant to Coal

64. Combined Cycle Power Plant

65. Gas Turbine Power Plant

66. Fuel Cell Power Plant

67. Demand Hydroelectric Power

68. Pumped Storage

69. Geothermal Power Complex

70. Solar Space Heating

71. Solar Space Conditioning

72. Geopressed Gas Recovery

73. Coal Solvent Refining

74. Fluidized Bed (Atoms) Power Plant

. Alaskan Oil Pipeline
. Oil Tanker
. Oil Barges
. Oil Tank Truck
. Products Pipeline
. Hot Oil Pipeline
. Refined Products Bulk Station
. Rail Line*

22. 345 kVac Transmission Lir
23. 500 kVac Transmission Lir
24. 765 kVac Transmission Lir
25. 400 kVac Transmission Lir
26. Electricity Distribution Aerial Lines
27. Electricity Distribution Underground Lines

al

. Mixed Train+
. Coal Unit Train
. Coal Slurry Pipeline
. Coal Slurry Preparation
. Coal Slurry Dewatering
. Coal Barges
. Coal Truck

s

. Gas Pipeline
. Gas Distribution Facilities
. Alaskan Gas Pipeline
. LNG Tanker

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ail line applies to a general track of line which could be used to ansport both energy and non-energy supplies. It is not limited to e transportation of oil.

mixed train typically transports coal and other energy resources.

| | |
|---|---|
| Government: | |
| Civilian government: | |
| Federal Government | 91 except Fed. military. |
| State and local government | 92, 93. |
| Armed forces | Part of 91. |

OURCE: Executive Office of the President, Bureau of the Budget, Standard Industrial Classification Manual, 1967.

| | | | | | |
|---|---|---|---|---|---|
| 1 | Coal | 1 | 7 | 7 | 7 |
| 2 | Crude Oil | 2 | 8 | 8 | 8 |
| | Crude Gas | | | | |
| 3 | Shale Oil | - | - | - | - |
| 4 | Methane from coal | 3 | - | - | - |
| 5 | Coal liquefaction | - | - | - | - |
| 6 | Refined oil products | 4 | 31.01 | part 31 | part 41 |
| 7 | Pipeline gas | 5 | 68.02 | 68.2 | 93 |
| 8 | Coal combined cycle electric | - | - | - | - |
| 9 | Other fossil electric | 6 | 68.01<br>78.02<br>79.02 | | |
| 10 | LWR electric | 7 | 68.01<br>78.02<br>79.02 | <br><br>68.1 | <br><br>92<br>part 10 |
| 11 | HTGR electric | - | - | | part 10 |
| | Hydroelectric | 8 | 68.01<br>78.02<br>79.02 | | |
| 12 | Geothermal | - | - | - | - |
| | Solar electric | - | - | - | - |
| | Solar direct | - | - | - | - |
| 13 | Ore reduction feedstocks | 9 | - | - | - |
| 14 | Chemical feedstocks | 10 | - | - | - |
| 15 | Motive power | 11 | - | - | - |
| 16 | Process heat | 12 | - | - | - |
| 17 | Water heat | 13 | - | - | - |
| 18 | Space heat | 14 | - | - | - |
| 19 | Air-conditioning | 15 | - | - | - |
| 20 | Electric power | 16 | - | - | - |
| 21 | Livestock and livestock products | 17 | 1 | 1 | 1 |
| 22 | Other agricultural products | 18 | 2 | 2 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| cultural, forestry and shery services | 20 | 4 | 4 | 4 | 4 |
| and ferroalloys ores ning | 21 | 5 | 5 | 5 | 5 |
| errous metal ores mining | 22 | 6 | 6 | 6 | 6- |
| e and clay mining, arrying | 23 | 9 | 9 | 9 | 10 |
| icals and fertilizer neral mining | 24 | 10 | 19 | 10 | 11 |
| construction, residen-al buildings | | 11.01 | 11.1 | 11 | 12 |
| construction, non-sidential buildings | | 11.02 | 11.2 | 12 | 13 |
| construction, public ilities | 25 | 11.03 | 11.3 | 13 | 14 |
| construction, highways | | 11.04 | 11.4 | 14 | 15 |
| construction, all other | | 11.05 | 11.5 | 15 | 16 |
| tenance and repair nstruction, residential | 26 | 12.01 | 12.1 | 16 | 17 |
| tenance and repair nstruction, all other | | 12.02 | 12.2 | 17 | |
| ance and accessories | 27 | 13 | 13 | 18 | 18- |
| and kindred products | 28 | 14 | 14 | 19 | 20 |
| cco manufacturers | 29 | 15 | 15 | 20 | 21 |
| d and narrow fabrics, rn and thread mills | 30 | 16 | 16 | 21 | 22 |
| . textile goods and oor coverings | 31 | 17 | 17 | 22 | 23 |
| rel | 32 | 18 | 18 | 23 | 24- |
| . fabricated textile oducts | 33 | 19 | 19 | 24 | 26 |

| | | | | | |
|---|---|---|---|---|---|
| | except containers | 34 | 20 | 20 | 25 |
| 44 | Wooden containers | 35 | 21 | 21 | 26 |
| 45 | Household furniture | 36 | 22 | 22 | 27 |
| 46 | Other furniture and fixtures | 37 | 23 | 23 | 28 |
| 47 | Paper and allied products except containers and boxes | 38 | 24 | 24.1<br>24.2<br>24.3 | 29<br>30<br>31 |
| 48 | Paperboard containers and boxes | 39 | 25 | 25 | 32 |
| 49 | Printing and publishing | 40 | 26 | 26 | 33 |
| 50 | Chemicals and selected chemical products | 41 | 27 | 27.1<br>27.2<br>27.3 | 34<br>35<br>36 |
| 51 | Plastics and synthetic materials | 42 | 28 | 28.1<br>28.2 | 37<br>38 |
| 52 | Drugs, cleaning and toilet preparations | 43 | 29 | 29 | 39 |
| 53 | Paints and allied products | 44 | 30 | 30 | 40 |
| 54 | Paving mixtures and blocks | 45 | 31.02 | part 31 | part 41 |
| 55 | Asphalt felts and coatings | 46 | 31.03 | part 31 | part 41 |
| 56 | Rubber and miscellaneous plastics products | 47 | 32 | 32.1<br>32.2<br>32.3 | 42<br>43<br>44 |
| 57 | Leather tanning and industrial leather products | 48 | 33 | 33 | 45 |
| 58 | Footwear and other leather products | 49 | 34 | 34 | 46 |
| 59 | Glass and glass products | 50 | 35 | 35 | 47 |
| 60 | Stone and clay products | 51 | 36 | 36 | 48 |

| | | | | | |
|---|---|---|---|---|---|
| nufacturing | 52 | 37 | 37 | 49 | 49- |
| ary non-ferrous metals | | | 38.1 | 50 | 51- |
| nufacturing | 53 | 38 | 38.2 | 51 | 51- |
| | | | 38.3 | 52 | |
| l containers | 54 | 39 | 39 | 53 | 58 |
| ing, plumbing and ricated structural tal products | 55 | 40 | 40 | 54 | 59- |
| w machine prod., bolts, ts, etc. & metal ampings | 56 | 41 | 41 | 55 | 61 |
| r fabricated metal oducts | 57 | 42 | 42 | 56 | 62 |
| nes and turbines | 58 | 43 | 43 | 57 | 63 |
| machinery | 59 | 44 | 44 | 58 | 64 |
| truction, mining, oil eld machinery, equipment | 60 | 45 | 45 | 59 | 65 |
| rials handling machinery d equipment | 61 | 46 | 46 | 60 | 66 |
| lworking machinery and uipment | 62 | 47 | 47 | 61 | 67 |
| ial industry machinery d equipment | 63 | 48 | 48 | 62 | 68 |
| ral industrial machinery d equipment | 64 | 49 | 49 | 63 | 69 |
| ine shop products | 65 | 50 | 50 | 64 | 70 |
| ce, computing and counting machines | 66 | 51 | 51 | 65 | 71- |
| ice industry machines | 67 | 52 | 52 | 66 | 73 |
| . trans. & dist. eq. & | | | 53.1 | 67 | 74 |
| ec. industry apparatus | 68 | 53 | 53.2 | 68 | 75 |

| | | | | |
|---|---|---|---|---|
| | communications equipment | 71 | 56 | 56 | 71 |
| 81 | Electronic components and accessories | 72 | 57 | 57.1<br>57.2<br>57.3 | 72<br>73<br>74 |
| 82 | Miscellaneous elec. machinery, equipment & supplies | 73 | 58 | 58 | 75 |
| 83 | Motor vehicles and equipment | 74 | 59 | 59 | 76 |
| 84 | Aircraft snd parts | 75 | 60 | 60 | 77 |
| 85 | Other transportation equipment | 76 | 61 | 61 | 78 |
| 86 | Professional, scientific & controlling inst. & supp. | 77 | 62 | 62 | 79 |
| 87 | Optical, opthalmic, & photographic equip. & supplies | 78 | 63 | 63 | 81 |
| 88 | Miscellaneous manufacturing | 79 | 64 | 64 | 82 |
| 89 | Railroads and related services | 80 | 65.01 | 65.1 | 83 |
| 90 | Local, urban and interurban highway pass. trans. | 81 | 65.02<br>79.01 | 65.2 | 84<br>part 10 |
| 91 | Motor freight transportation and warehousing | 82 | 65.03 | 65.3 | 85 |
| 92 | Water transportation | 83 | 65.04 | 65.4 | 86 |
| 93 | Air transportation | 84 | 65.05 | 65.5 | 87 |
| 94 | Pipeline transportation | 85 | 65.06 | 65.6 | 88 |
| 95 | Transportation services | 86 | 65.07 | 65.7 | 89 |
| 96 | Communications except radio & television broadcasting | 87 | 66 | 66 | 90 |

| | | | | | |
|---|---|---|---|---|---|
| and sanitary services | 89 | 68.03 | 68.3 | 94 | 103 |
| sale and retail trade | 90 | 69 | 69 | 95 | 104- |
| ce and insurance | 91 | 70 | 70 | 96 | 106- |
| estate & rental | 92 | 71 | 71 | 97 | 108- |
| s & lodging; pers. & air serv., except auto | | | | | |
| ir | 93 | 72 | 72 | 98 | 110- |
| ness services | 94 | 73 | 73 | 99 | 112- |
| obile repair & vices | 95 | 75 | 75 | 101 | 115 |
| ements | 96 | 76 | 76 | 102 | 116- |
| al, educ., services | | | | | |
| n-profit inst. | 97 | 77 | 77 | 103 | 118- |
| al Government erprises | 98 | 78.01 | - | part 104 | 122 |
| | | 78.04 | - | | 124 |
| and local govern- enterprises | 99 | 79.03 | - | part 105 | part 1 |
| ness travel, enter- ment & gifts | 100 | 81 | - | 107 | 128 |
| ce supplies | 101 | 82 | - | 108 | 129 |
| arch & development | - | 74* | - | 100 | - |
| s imports | - | 80 | - | 106 | 126 |
| p, used and second d goods | - | 83 | - | 109 | 130 |
| rnment industry | - | 84 | - | - | 131 |
| of world industry | - | 85 | - | - | 132 |
| eholds | - | 86 | - | - | 133 |
| ntory valuation ustment | - | 87 | - | - | 134 |

ed as a separate sector by BEA in the 1963 and 1967 studies.

Code:
- BNL 110 - Brookhaven National Laboratory 110 sector version
- BNL 101 - Brookhaven National Laboratory 101 sector version
- BEA - Bureau of Economic Analysis, U.S. Dept. of Commerce
- Battelle - Battelle Memorial Institute; used in An "Ex Ante" Capital Maxtrix for the United States, 1970-1975
- A. Carter - Professor Ann Carter, Brandeis University
- BLS - Bureau of Labor Statistics, U.S. Dept. of Labor
- DRI 18 - Data Reaources, Inc., 18 sector interindustry model

ne first 12 sectors of the I-O are energy supply/conversion sectors transform basic energy resources into usable (product) forms of energ e of meeting final, end-use demand. They depict actual, physical ion processes and are defined below.

. Coal. The coal sector produces raw coal as it comes from the mine tal output is measured in Btu's of raw coal. It is assumed that sect sing this coal do their own crushing and cleaning.

. Crude Oil and Gas. This sector's total output is the summation of of crude oil at the wellhead and Btu's of associated and nonassociate ad gas that are produced domestically. As an accounting convenience, sing losses for domestic gas and refining losses for both imported an ic crude oil are represented by the diagonal A-matrix coefficient for .* This permits energy transfer from the crude oil and gas sector to fined oil products sector to be measured by Btu's of refined oil prod o permits energy transfer to the pipeline gas sector to be measured b of processed gas.

. Shale Oil. The shale oil sector produces a crude oil substitute, tal output is measured in terms of Btu's of crude oil. As an account ience, refining losses are represented by the diagonal A-matrix coeff and this sector actually transfers Btu's of refined oil products to l oil products sector.

. Methane from Coal. This sector produces a high Btu, pipeline-qual tic gas from coal by the HYGAS process. The coal input is considered coal, the same unit of measure as the output of the coal sector. Th ed is a direct substitute for processed natural gas, and all of it is red to the pipeline gas sector.

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er or not one accounts for energy conversion or distribution losses i rial as long as one is not formulating the I-O itself as an optimizat What is crucial, however, is the unit of measurement adopted for to (total domestic production) from esch energy supply sector. This me orrespond with the units used to renormalize I-O coefficient column s for the energy sectors from dollars of input per dollar of output t s of input per Btu of output.

via coal liquefaction, new costs and conversion efficiencies have been
lated and inserted into BESOM.

6. Refined Oil Products. This sector refines all imported and d
crude oil, domestic shale oil, and domestic liquefied coal. Its outpu
measured by Btu's of refined petroleum products, and imports of refine
are not included in the measure of domestic production.

7. Pipeline Gas. This sector, in essence, distributes high Btu,
pipeline-quality gas, and total output is measured by Btu's of process
gas produced domestically. Total output does not include imported pip
from Canada or imported LNG, substitutes for that produced domesticall
Consumption of gas by pipeline pumping stations is accounted for by a
coefficient in the diagonal A-matrix entry for this sector. Transfers
other sectors are therefore measured by Btu's of delivered gas at the
utilization.

8. Coal Combined-Cycle Electric. This sector produces electrici
combined low-Btu coal gasification and COGAS generation processes. To
is measured by Btu's of generated electricity. Transmission and distr
losses are tabulated in the diagonal A-matrix entry for this sector, a
bution to all other sectors is measured by Btu's of distributed electr
conventions adopted for all of the electric generation sectors.

9. Other Fossil Electric. This sector combines electricity prod
from conventional coal-fired boilers, oil-fired boilers, gas-fired boi
oil-fired gas turbines, oil-fired steam electric combined cycle, and o
total energy systems.

10. LWR Electric. This sector produces electricity from light wa
nuclear reactors.

11. HTGR Electric. This sector produces electricity from high-te
gas-cooled reactors.

12. Hydroelectric. This sector combines electricity production f
(1) hydroelectric generation plants; (2) geothermal steam electric-gen
plants; (3) pumped storage plants; and (4) solar electric central inst
Electrical transmission losses in the diagonal element of the A-matrix
represented for the first two and the last electric generation methods
for pumped storage.

13. Ore Reduction Feedstocks, ORF. This sector distributes coke fo
reduction purposes.

14. Chemical Feedstocks, CF. This sector distributes feedstocks fo
ical industries in the raw form used by those industries such as naph
ane, as well as lubricants and greases used by all industries.

15. Motive Power, MP. This sector's output is measured in terms of
lable at a drive shaft for transport purposes regardless of the fuel
ide that power. Electric rail transport is not included, however.

16. Process Heat, PH. This sector supplies all heating requirement
uding industrial process heat, cooking heat, and clothes drying.

17. Water Heat, WH. The output of this sector is measured in terms
s of heat added to water for any purpose other than steam for process
pace heat.

18. Space Heat, SH. The output of this sector is measured in terms
s of heat added to a building regardless of fuel or type of heating s

19. Air Conditioning, AC. This sector's output is Btu's of heat re
the air being conditioned.

20. Electric Power, EP. This sector's output includes all
ubstitutable uses of transmitted and distributed electricity such as
ting, appliances, other electric drive, industrial electrolysis, etc.
tricity used for motive power in electric rail and mass transit syste
included in this sector.

A. 16-sector aggregation includes:

1. Agriculture
2. Non-fuel mining
3. Coal mining
4. Crude petroleum and natural gas
5. Chemicals manufacturing
6. Petroleum refining
7. Motor vehicle manufacturing
8. Other manufacturing
9. Transportation
10. Sanitary services, communications, water
11. Electric utilities
12. Gas utilities
13. Trade
14. Finance, insurance, real estate
15. Services
16. Construction

B. 103-sector aggregation includes:

| | | |
|---|---|---|
| 1. | Dairy farm products, poultry and eggs | 0132, 0133, 0134, pt. 014 |
| 2. | Meat animals and miacellaneous livestock products | 0135, 0136, 0139, pt. 014 0193, pt. 0729 |
| 3. | Cotton | 0112, pt. 014 |
| 4. | Food feed grains and grass seeds | 0113, pt. 0119, pt. 014 |
| 5. | Forest, greenhouse, and nursery products | 0192, pt. 014 |
| 6. | Forestry and fishery products | 074, 081, 082, 084, 086 |
| 7. | Other crops and services | pt. 0114, 0122, 0123 pt. 0119, pt. 0113 pt. 014, 071, 0723, 073 pt. 0729, 085, 098 |

ining

| | | |
|---|---|---|
| 8. | Metal mining | 10 |
| 9. | Coal mining | 11, 12 |
| 0. | Crude petroleum and natural gas | 131, 132 |
| 1. | Stone and clay mining and quarrying | 141, 142, 144, 145, 148, 149 |
| 2. | Chemicals and fertilizer mineral mining | 147 |

onstruction

| | | |
|---|---|---|
| 3. | Residential buildings | pt. 15, pt.16, pt.17, pt.65 |
| 4. | Non-residential buildings | pt. 15, pt. 17 |

| | | |
|---|---|---|
| 15. | New electric utility facilities | pt. 16, pt. |
| 16. | New gas utility facilities | pt. 16, pt. |
| 17. | New petroleum pipelines | pt. 16, pt. |
| 18. | New local transit facilities | pt. 16, pt. |
| 19. | New highways | pt. 16, pt. |
| 20. | New oil and gas wells | pt. 138 |
| 21. | New oil and gas exploration | pt. 138 |
| 22. | Maintenance and repair of oil and gas wells | pt. 138 |
| 23. | All other construction | pt. 15, pt. |
| Manufacturing | | |
| 24. | Meat products | 201 |
| 25. | Dairy products | 202 |
| 26. | Canned, cured, and frozen products | 203 |
| 27. | Grain mill products | 204 |
| 28. | Bakery products | 205 |
| 29. | Beverages | 208 |
| 30. | Miscellaneous food products | 206, 207, 20 |
| 31. | Textile mill products | 22 |
| 32. | Apparel and other fabric products | 23 |

| | | |
|---|---|---|
| 33. | Lumber products | 24 |
| 34. | Furniture and fixtures | 25 |
| 35. | Paper mills | 262 |
| 36. | Paper products | 26 (excl. 262) |
| 37. | Printing and publishing | 27 |
| 38. | Industrial inorganic and organic chemicals | 281 (excl. 28195) |
| 39. | Plastic materials and resins | 2821 |
| 40. | Synthetic rubber | 2822 |
| 41. | Other plastics and synthetics | 2823, 2824 |
| 42. | Drugs, cleaning and toilet preparations | 283, 284 |
| 43. | Paints and allied products | 285 |
| 44. | Agricultural chemicals | 287 |
| 45. | Carbon black | 2895 |
| 46. | Miscellaneous chemical products | 286, 289 (excl. 2895) |
| 47. | Petroleum refining | 2911, 299 |
| 48. | Paving mixtures and blocks | 2951 |
| 49. | Asphalt felts and coatings | 2952 |
| 50. | Rubber | 30 |

| | | |
|---|---|---|
| 51. | Glass and glass products | 321, 322, 323 |
| 52. | Cement, hydraulic | 324 |
| 53. | Clay | 325 |
| 54. | Concrete, lime, and gypsum | 327 |
| 55. | Other stone and clay products | 326, 328, 329 |
| 56. | Primary aluminum | 3334, 28195 |
| 57. | Aluminum rolling and drawing | 3352 |
| 58. | Primary iron and steel manufacturing | 331, 332, 339 (exc. |
| 59. | Other primary metal manufacturing | 333, 334, 335, 336 (excl. 3334, 3352) |
| 60. | Fabricated structural steel | 3441 |
| 61. | Other fabricated metals, ordnance | 34, 19 (excl. 3441 |
| 62. | Engines and turbines | 351 |
| 63. | Farm machinery | 352 |
| 64. | Construction and materials handling | 353 |
| 65. | Metal working machinery | 354 |
| 66. | Special industrial machinery | 355 |
| 67. | General industrial machinery | 356 |
| 68. | Office and computing machinery | 357 |

| | | |
|---|---|---|
| 69. | Service and miscellaneous machinery, excluding electrical | 358, 359 |
| 70. | Carbon and graphic products | 3624 |
| 71. | Electrical apparatus and motors | 361, 362 (excl. 3624) |
| 72. | Household appliances | 363 |
| 73. | Electrical lighting and wiring equipment | 364 |
| 74. | Communications equipment | 365, 366 |
| 75. | Electronic components | 367 |
| 76. | Batteries and miscellaneous electrical equipment | 369 |
| 77. | Motor vehicle and equipment | 371 |
| 78. | Aircraft and parts | 372 |
| 79. | Other transportation equipment | 37 (excl. 371, 372) |
| 80. | Instruments and clocks | 381, 382, 384, 387 |
| 81. | Photographic equipment | 383, 385, 386 |
| 82. | Other manufacturing | 21, 31, 39 |

Transportation, Communications, Public Utilities

| | | |
|---|---|---|
| 83. | Railroads | 40, 474 |
| 84. | Trucking and warehousing | 42, 473 |
| 85. | Air transportation | 45 |

| | | |
|---|---|---|
| 86. | Highway passenger transportation | 41 |
| 87. | Water transportation | 44 |
| 88. | Transportation services | 47 (excl. 473, 474 |
| 89. | Pipeline transportation | 46 |
| 90. | Communications | 481, 482 |
| 91. | Radio and TV broadcasting | 483 |
| 92. | Electric utilities | 491, pt. 493 |
| 93. | Gas utilities | 492, pt. 493 |
| 94. | Water and sanitary services | 494, 495, 496, 497 |
| | Wholesale and Retail Trade | |
| 95. | Wholesale and retail trade | 50, 52-59, 7396, p |
| | Finance, Insurance, Real Estate | |
| 96. | Finance, insurance | 60-67 (excl. 65) |
| 97. | Real estate | 65 (excl. pt. 6561 |
| | Services | |
| 98. | Hotel and lodging places | 70 |
| 99. | Auto repair and services | 75 |
| 100. | Personal and repair services | 72, 76 (excl. 7692 and pt. 7699) |

| | | |
|---|---|---|
| 101. | Business serivces | 73 (excl. 7396), 7692, 7694, pt. 7699 |
| 102. | Amusement and recreation services | 78, 79 |
| 103. | Professional services | 80, 81, 82, 84, 86, 89 (excl. 8099) |

| | | |
|---|---|---|
| 1. | Agr., Livestock | Group 013 - Livestock |
| 2. | Agr., Crops | All of Major Group 01 - Agricultura Production, Except Group 013 - L |
| 3. | Coal Mining | Major Group 12 - Bituminous Coal a Lignite Mining |
| 4. | Contract Construction | Division C - Contract Construction Groups 15, 16, and 17) |
| 5. | Transportation | All Division E - Transportation, C tions, Electric, Gas, and Sanita Services, Except Major Groups 48 |
| 6. | Communication and Utilities | Major Group 48 - Communication and Group 49 - Electric, Gas, and Sa Services (Except Industry No. 49 |
| 7. | Processing and Misc. Manufacturing[b] | Major Group 50 - Wholesale Trade a Group 20 - Food and Kindred Prod Manufacturing |
| 8. | Retail Trade | All of Division F - Wholesale and R Trade, Except Major Group 50 - W Trade |
| 9. | Finance, Insurance, and Real Estate | Division G - Finance, Insurance, a Estate |
| 10. | Business and Personal Services | All Division H - Services, Except M Groups 80, 81, 82, 86, and 89 |
| 11. | Professional and Social Services | Major Group 80 - Medical and Other Services, Major Group 81 - Legal Services, Major Group 82 - Educat Services, Major Group 86 - Non-pr Membership Organizations, Major C Miscellaneous Services |
| 12. | Households | Not Applicable |
| 13. | Government | Division I - Government |

[a]Executive Office of the President/Bureau of the Budget, Standard Industrial Classification Manual, 1967, U.S. Government Printing Washington, D.C., 1967.

[b]Wholesale trade, although relatively insignificant, is included Sector 7.

| Years of Construction Before Operation Begins | Acres of Farmland Lost | Acres Mined Per Year | Acres of Farmland Taken for Urban Use Per In-Migrant | Tons Mined Per Year | KWH Sold | SNG Sold | Mine Value |
|---|---|---|---|---|---|---|---|
| 4 | 200 | 660 | 0.563 | 6,600,000 | 0 | 0 | $5,583,6 |

| Project Year | Economic Sector: | Final Demand Vectors ($000 000) 4 | 8 | 12 |
|---|---|---|---|---|
| 1 | | 2.77 | 0.86 | 0.69 |
| 2 | | 2.82 | 2.91 | 1.72 |
| 3 | | 1.08 | 1.99 | 3.41 |
| 4 | | 1.65 | 4.60 | 4.90 |
| 5 | | 0 | 2.23 | 6.94 |
| 6 | | 0 | 2.60 | 7.38 |
| 7 | | 0 | 2.60 | 7.10 |
| 8-25 | | 0 | 2.60 | 7.16 |

Direct Labor (Man-Years)

| Project Year: | 1 | 2 | 3 | 4 | 5-2 |
|---|---|---|---|---|---|
| Construction (or Temporary): | 125 | 50 | 125 | 50 | 0 |
| Operation (or Permanent): | 38 | 103 | 145 | 185 | 225 |

Specified by user.

| | | | |
|---|---|---|---|
| 6 | 1975 | 38 | UPA-CPA Coal Electric Gen and Assoc. M Phase I |

| Years of Construction Before Operation Begins | Acres of Farmland Lost | Acres Mined Per Year | Acres of Farmland Taken for Urban Use Per In-Migrant | Tons Mined Per Year | KWH Sold |
|---|---|---|---|---|---|
| 4 | 2,986 | 206.5 | 0.563 | 2,800,000 | 3,250,000,000 |

| Project Year | Economic Sector: | Final Demand Vectors ($000 000) 4 | 8 | 12 |
|---|---|---|---|---|
| 1 | | 4.24 | 0.28 | 2.9 |
| 2 | | 12.73 | 0.85 | 9.1 |
| 3 | | 16.37 | 1.09 | 17.2 |
| 4 | | 16.98 | 1.13 | 25.8 |
| 5 | | 9.70 | 1.82 | 19.3 |
| 6 | | 0.61 | 1.21 | 5.0 |
| 7 | | 0 | 2.34 | 5.8 |
| 8-25 | | 0 | 2.34 | 5.8 |

Direct Labor (Man-Years)

| Project Year: | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Construction (or Temporary): | 225 | 720 | 1,500 | 2,250 | 1,500 | 50 |
| Operation (or Permanent): | 35 | 110 | 190 | 290 | 393 | 448 |

*Specified by user.

| | | | |
|---|---|---|---|
| 1980 | 14 | 300 MGPL 250 MCFD Natural Gas Plant and 14 MTPY Mine | |

| ol ion e on s | Acres of Farmland Lost | Acres Mined Per Year | Acres of Farmland Taken for Urban Use Per In-Migrant | Tons Mined Per Year | KWH Sold | SNG Sold | Mine Value |
|---|---|---|---|---|---|---|---|
| | 600 | 350 | 0.563 | 14,000,000 | 0 | 91,000,000,000 | $11,844,000 |

| Project Year | Economic Sector: | Final Demand Vectors ($000 000) 4 | 8 | 12 |
|---|---|---|---|---|
| 1 | | 1.20 | 5.61 | 7.50 |
| 2 | | 4.80 | 22.43 | 29.98 |
| 3 | | 6.83 | 31.94 | 42.70 |
| 4 | | 7.21 | 33.74 | 45.11 |
| 5 | | 0.94 | 13.21 | 23.40 |
| 6 | | 0.26 | 11.03 | 21.17 |
| 7 | | 0.17 | 10.08 | 22.34 |
| 8 | | 0 | 10.08 | 20.95 |
| 9-25 | | 0 | 10.08 | 20.06 |

Direct Labor (Man-Years)

| Year: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| tion (or Temporary): | 700 | 2,800 | 1,952 | 4,088 | 500 | 106 | 64 | | |
| n (or Permanent): | | | | | 893 | 1,001 | 1,086 | 1,075 | 1,06 |

ed by user.

| Sector | Corresponding SIC Group | Empl Rati Mill |
|---|---|---|
| 1. Livestock and Livestock Products | 01-02 | |
| 2. Crops and Other Agricultural Products | 01-02 | |
| 3. Forestry and Fisheries | 07-09 | |
| 4. Agriculture, Forestry, and Fishery Services | 07-09 | |
| 5. Iron Ore Mining | 101, 106 | |
| 6. Copper Ore Mining | 102 | |
| 7. Other Non-ferrous Metal Ore Mining | 103-107<br>107-109 | |
| 8. Coal Mining | 11, 12 | |
| 9. Crude Petroleum | 13 | |
| 10. Stone and Clay Mining and Quarrying | 141-145,<br>148, 149 | |
| 11. Chemical and Fertilizer Mining | 147 | |
| 12. New Residential Building Construction | 15, 16, 17 | |
| 13. New Non-Residential Building Construction | 15, 16, 17 | |

*BLS data is not sufficient for computation of employment-o ratios for Sectors 12-17.

| Sector | Corresponding SIC Group | Ratios (Jobs Per Million Dollars o Output) |
|---|---|---|
| New Public Utilities Construction | 15, 16, 17 | ---* |
| New Highway Construction | 15, 16, 17 | ---* |
| All Other New Construction | 15, 16, 17 | ---* |
| Maintenance and Repair Construction | 15, 16, 17 | ---* |
| Guided Missiles and Space Vehicles | 1925 | ---* |
| Other Ordnance | 19 except 1925 | ---* |
| Food Products | 20 | 13.10 |
| Tobacco Manufacturing | 21 | 6.58 |
| Fabric, Yarn, and Thread Mills | 221-224, 225, 228 | 22.50 |
| Miscellaneous Textiles and Floor Construction | 227, 229 | 10.31 |
| Hosiery and Knit Goods | 225 | 20.35 |
| Apparel | 23 except 239 | 40.32 |
| Miscellaneous Fabricated Textiles Products | 239 | 20.15 |
| Logging, Sawmills, and Planing Mills | 241, 242 | 31.14 |

S data is not sufficient for computation of employment-output ios for Sectors 12-17.

| Sector | Corresponding SIC Group | Ratio Mill |
|---|---|---|
| 28. Millwork, Plywood, and Other Wood Products | 243, 244, 249 | |
| 29. Household Furniture | 251 | |
| 30. Other Furniture | 25 except 251 | |
| 31. Paper Products | 26 except 265 | |
| 32. Paperboard | 265 | |
| 33. Publishing | 271-274 | |
| 34. Printing | 275-279 | |
| 35. Chemical Products | 281, 286, 289 | |
| 36. Agricultural Chemicals | 287 | |
| 37. Plastic Materials and Synthetic Rubber | 2821, 2822 | |
| 38. Synthetic Fibers | 2823, 2824 | |
| 39. Drugs | 283 | |
| 40. Cleaning and Toilet Preparations | 284 | |
| 41. Paint | 285 | |
| 42. Petroleum Products | 29 | |
| 43. Rubber Products | 30 except 307 | |

| | Sector | Corresponding SIC Group | Ratios (Jobs Per Million Dollars Output) |
|---|---|---|---|
| 4. | Plastic Products | 307 | 16.73 |
| 5. | Leather, Footwear, and Leather Products | 31 | 60.62 |
| 6. | Glass | 321-323 | 31.25 |
| 7. | Cement, Clay, and Concrete Products | 324, 325, 327 | 29.21 |
| 8. | Miscellaneous Stone and Clay Products | 326, 328, 329 | 35.54 |
| 9. | Blast Furnaces and Basic Steel Products | 331 | 19.28 |
| 10. | Iron and Steel Foundries and Forgings | 332, 3391, 3399 | 34.48 |
| 11. | Primary Copper Metals | 3331 | 4.26 |
| 12. | Primary Aluminum | 3334 | 5.96 |
| 13. | Other Primary and Secondary Non-Ferrous Metal | 3332, 3333, 3339, 334 | 5.99 |
| 14. | Copper Rolling and Drawing | 3351 | 13.89 |
| 15. | Aluminum Rolling and Drawing | 3352 | 14.26 |
| 16. | Other Non-Ferrous Rolling and Drawing | 3356, 3357 | 18.22 |
| 17. | Miscellaneous Non-Ferrous Metal Products | 336, 3392 | 42.67 |

| | Sector | Corresponding SIC Group | Ratios ( Million Out |
|---|---|---|---|
| 58. | Metal Containers | 341, 3491 | 16 |
| 59. | Heating Apparatus and Plumbing Fixtures | 343 | 24 |
| 60. | Fabricated Structural Metal | 344 | 30 |
| 61. | Screw Machine Products | 345, 346 | 47 |
| 62. | Other Fabricated Metal Products | 342, 347-349 except 3491 | 27 |
| 63. | Engines, Turbines, and Generators | 351 | 13 |
| 64. | Farm Machinery | 352 | 19 |
| 65. | Construction, Mining, and Oilfield Machinery | 3531-3533 | 25 |
| 66. | Material Handling Equipment | 3534-3537 | 22 |
| 67. | Metalworking Machinery | 354 | 34 |
| 68. | Special Industry Machinery | 355 | 26 |
| 69. | General Industrial Machinery | 356 | 21 |
| 70. | Machine Shop Products | 359 | 56 |
| 71. | Computers and Peripheral Equipment | 3573-3574 | 21 |

| | Sector | Corresponding SIC Group | Ratios ( Million I Outp |
|---|---|---|---|
| 72. | Typewriters and Other Office Machines | 357 except 3573, 3574 | 22 |
| 73. | Service Industry Machines | 358 | 10 |
| 74. | Electric Transmission Equipment | 361 | 29 |
| 75. | Electrical Industrial Apparatus | 362 | 27 |
| 76. | Household Appliances | 363 | 15 |
| 77. | Electric Lighting and Wiring | 364 | 29 |
| 78. | Radio and Television Sets | 365 | 7 |
| 79. | Telephone and Telegraph Apparatus | 3661 | 21 |
| 80. | Other Electronic Communication Equipment | 3662 | 19 |
| 81. | Electronic Components | 367 | 18 |
| 82. | Other Electrical Machinery | 369 | 19 |
| 83. | Motor Vehicles | 371 | 9 |
| 84. | Aircraft | 372 | 25 |
| 85. | Ship and Boat Building and Repair | 373 | 35 |
| 86. | Railroad and Other Transportation Equipment | 374-375 | 12 |

| | Sector | Corresponding SIC Group | Millio Ou |
|---|---|---|---|
| 87. | Miscellaneous Transportation Equipment | 379 | |
| 88. | Scientific and Controlling Instruments | 381, 382, 387 | |
| 89. | Medical and Dental Instruments | 384 | |
| 90. | Optical and Ophthalmic Equipment | 383, 385 | |
| 91. | Photographic Equipment and Supplies | 386 | |
| 92. | Miscellaneous Manufactures Products | 39 | |
| 93. | Railroad Transportation | 40, 474 | |
| 94. | Local Transit and Intercity Bus | 41 | |
| 95. | Truck Transportation | 42, 473 | |
| 96. | Water Transportation | 44 | |
| 97. | Air Transportation | 45 | |
| 98. | Other Transportation | 46, 47 except 473, 474 | |
| 99. | Communications, except Radio, TV | 48 except 483 | |
| 100. | Radio and TV Broadcasting | 483 | |

| | Sector | Corresponding SIC Group | Employment Coefficient Ratios (Jobs Per Million Dollar Output) |
|---|---|---|---|
| 01. | Electric Utilities | 491, part 493 | 11.80 |
| 02. | Gas Utilities | 492, part 493 | 9.33 |
| 03. | Water and Sanitary Services | 494-497, part 493 | 18.77 |
| 04. | Wholesale Trade | 50 | 40.28 |
| 05. | Retail Trade | 52-59 | 103.39 |
| 06. | Finance | 60-62, 67 | 55.47 |
| 07. | Insurance | 63, 64 | 46.39 |
| 08. | Owner-Occupied Dwellings | SIC not comparable | NA |
| 09. | Other Real Estate | 65, 66 | 12.06 |
| 10. | Hotels and Lodging Places | 70 | 196.83 |
| 11. | Other Personal Services | 72, 76 | 126.74 |
| 12. | Miscellaneous Business Services | 73 except 731 | 83.81 |
| 13. | Advertising | 731 | 7.42 |
| 14. | Miscellaneous Professional | 81, 89 except 892 | 61.64 |
| 15. | Automobile Repair | 75 | 34.01 |
| 16. | Motion Pictures | 78 | 56.87 |

| | Sector | Corresponding SIC Group | Ratios (Million Do Outpu |
|---|---|---|---|
| 117. | Other Amusements | 79 | 100.3 |
| 118. | Health Services except Hospitals | 80 except 806 | 97. |
| 119. | Hospitals | 806 | 124.3 |
| 120. | Educational Services | 82 | 126.7 |
| 121. | Non-Profit Organizations | 84, 86, 892 | 130.4 |
| 122. | Post Office | 4311 | 82.8 |
| 123. | Commodity Credit Corporation | SIC not comparable | NA |
| 124. | Other Federal Enterprises | SIC not comparable | 39.3 |
| 125. | State and Local Government Enterprises | SIC not comparable | 51.9 |
| 126. | Directly Allocated Imports | Dummy Sectors | NA |
| 127. | Transferred Imports | Dummy Sectors | NA |
| 128. | Business Travel, Entertainment, and Gifts | Dummy Sectors | NA |
| 129. | Office Supplies | Dummy Sectors | NA |

| or e | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | AGRILCULTURE, FORESTRY & FISHERIES | |
| 0 | 1 | Fruit & Vegetable Products | 0122, 0123 |
| 2 | 2 | Dairy Products | 0132 |
| 3 | 3 | Poultry Products | 0133, 0134 |
| 0 | 4 | Other Agricultural Products | 011, 0135, 01 019, 0729 pt, |
| 8 | 5 | Agricultural, Forestry, & Fishery Services | 071, 0723, 07 085, 098 |
| 9 | 6 | Forestry & Fishery Products | 074, 081, 082 086, 091 |
| | | MINING | |
| 1 | 7 | Dimension Stone | 1411 |
| 1 | 8 | Crushed & Broken Stone | 142 |
| 1 | 9 | Sand & Gravel | 144 |
| 0 | 10 | Mining, not elsewhere classified | 145, 148, 149 |
| | | CONSTRUCTION | |
| 9 | 11 | Maintenance & Repair Construction Allocator | (NA) |
| 1 | 12 | General Contractors | 1511 |
| 1 | 13 | Highway & Street Construction | 1611 |
| 1 | 14 | Heavy Construction | 1621 |
| 1 | 15 | Special Trade Contractors, not elsewhere classified | 172, 174, 175 177, 178, 179 |
| 1 | 16 | Plumbing, Heating, & Air-Conditioning Contractors | 1711 |
| 1 | 17 | Electrical Contractors | 1731 |

TABLE C-8 (continued)

| Sector Code | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | MANUFACTURING | |
| 1900 | 18 | Ordnance & Accessories | 19 |
| 2011 | 19 | Meat-Packing Plants | 2011 |
| 2013 | 20 | Sausage & Other Prepared Meat Products | 2013 |
| 2015 | 21 | Poultry & Small Game Dressing & Packing | 2015 |
| 2020 | 22 | Creamery Butter & Natural Cheese | 2021, |
| 2024 | 23 | Ice Cream & Frozen Desserts | 2024 |
| 2026 | 24 | Fluid Milk | 2026 |
| 2031 | 25 | Canned & Cured Sea Foods | 2031 |
| 2032 | 26 | Canned Specialties | 2032 |
| 2033 | 27 | Canned Fruits, Vegetables, Preserves, Jams & Jellies | 2033 |
| 2034 | 28 | Dried & Dehydrated Fruit & Vegetables | 2034 |
| 2035 | 29 | Pickled Fruits & Vegetables | 2035 |
| 2036 | 30 | Fresh or Frozen Packaged Fish | 2036 |
| 2037 | 31 | Frozen Fruits, Fruit Juices, Vegetables & Specialties | 2037 |
| 2041 | 32 | Flour & Other Grain Mill Products | 2041 |
| 2042 | 33 | Prepared Feeds for Animals & Fowls | 2042 |
| 2043 | 34 | Cereal Preparations | 2043 |
| 2045 | 35 | Blended & Prepared Flour | 2045 |
| 2046 | 36 | Wet Corn Milling | 2046 |
| 2051 | 37 | Bread & Other Bakery Products | 2051 |
| 2052 | 38 | Biscuit, Crackers & Pretzels | 2052 |
| 2062 | 39 | Cane Sugar Refining | 2062 |
| 2071 | 40 | Candy & Other Confectionery | 2071 |
| 2072 | 41 | Chocolate & Cocoa Products | 2072 |

| Sector Code | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | MANUFACTURING (Continued) | |
| 2084 | 44 | Wines, Brandy & Brandy Spirits | 2084 |
| 2085 | 45 | Distilled, Rectified, & Blended Liquors | 2085 |
| 2086 | 46 | Bottled & Canned Soft Drinks & Carbonated Waters | 2086 |
| 2087 | 47 | Flavoring Extractions & Flavoring Syrups | 2087 |
| 2090 | 48 | Food Preparations, not elsewhere classified | 2025, 2099 |
| 2094 | 49 | Animal & Marine Fats & Oils | 2094 |
| 2095 | 50 | Roasted Coffee | 2095 |
| 2096 | 51 | Shortening, Table Oils, Margarine | 2096 |
| 2097 | 52 | Manufactured Ice | 2097 |
| 2111 | 53 | Cigarettes | 2111 |
| 2121 | 54 | Cigars | 2121 |
| 2131 | 55 | Tobacco & Snuff | 2131 |
| 2211 | 56 | Broad Woven Fabric Mills, Cotton | 2211 |
| 2221 | 57 | Broad Woven Fabric Mills, Man-Made Fiber & Silk | 2221 |
| 2231 | 58 | Broad Woven Fabric Mills, Wool | 2231 |
| 2241 | 59 | Narrow Fabrics & Other Smallwares Mills | 2241 |
| 2251 | 60 | Women's Full-Length & Knee-Length Hosiery Mills | 2251 |
| 2252 | 61 | Other Hosiery Mills | 2252 |
| 2253 | 62 | Knit Outerwear Mills | 2253 |
| 2254 | 63 | Knit Underwear Mills | 2254 |
| 2256 | 64 | Knit Fabric Mills | 2256 |
| 2259 | 65 | Knitting Mills, not elsewhere classified | 2259 |
| 2261 | 66 | Finishers of Broad Woven Fabrics of Cotton | 2261 |

TABLE C-8 (continued)

| bsolute Number | Title | 1967 SIC |
|---|---|---|
| | MANUFACTURING (Continued) | |
| 67 | Finishers of Broad Woven Fabrics of Man-Made Fiber & Silk | 2262 |
| 68 | Dying & Finishing Textiles, not elsewhere classified | 2269 |
| 69 | Woven Carpets & Rugs | 2271 |
| 70 | Tufted Carpets & Rugs | 2272 |
| 71 | Carpets, Rugs, & Mats, not elsewhere classified | 2279 |
| 72 | Yarn Spinning Mills | 2281 |
| 73 | Yarn Throwing, Twisting, & Winding Mills | 2282 |
| 74 | Yarn Mills, Wool, Including Carpet & Rug Yarn | 2283 |
| 75 | Thread Mills | 2284 |
| 76 | Felt Goods, Excluding Woven Felts & Hats | 2291 |
| 77 | Lace Goods | 2292 |
| 78 | Padding & Upholstery Filling | 2293 |
| 79 | Processed Waste & Recovered Fibers & Flock | 2294 |
| 80 | Artificial Leather, Oilcloth, etc. | 2295 |
| 81 | Wool Scouring, Worsted Combing, & Tow-to-Top Mills | 2297 |
| 82 | Cordage & Twine | 2298 |
| 83 | Textile Goods, not elsewhere classified | 2299 |
| 84 | Men's, Youths', & Boys' Suits, Coats, & Overcoats | 2311 |
| 85 | Men's, Youths', & Boys' Shirts, Collars, Nightwear | 2321 |
| 86 | Men's, Youths', & Boys' Underwear | 2322 |

| or le | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | MANUFACTURING (Continued) | |
| 28 | 89 | Work Clothing | 2328 |
| 29 | 90 | Men's, Youths' & Boys' Clothing not elsewhere classified | 2329 |
| 31 | 91 | Blouses, Waists, & Shirts | 2331 |
| 35 | 92 | Dresses | 2335 |
| 37 | 93 | Suits, Shirts & Coats, Excluding Fur Coats & Raincoats | 2337 |
| 39 | 94 | Women's, Misses', & Juniors' Outerwear, not elsewhere classified | 2339 |
| 41 | 95 | Women's, Misses', Children's & Infants' Underwear | 2341 |
| 42 | 96 | Corsets & Allied Garments | 2342 |
| 51 | 97 | Millinery | 2351 |
| 52 | 98 | Men's & Boys' Hats & Caps | 2352 |
| 61 | 99 | Dresses, Blouses, Waists, & Shirts | 2361 |
| 63 | 100 | Coats & Suits | 2363 |
| 69 | 101 | Girls', Children's & Infants' Outerwear, not elsewhere classified | 2369 |
| 71 | 102 | Fur Goods | 2371 |
| 81 | 103 | Dresses & Work Gloves, Excluding Knit & All Leather | 2381 |
| 84 | 104 | Robes & Dressing Gowns | 2384 |
| 85 | 105 | Raincoats & Other Waterproof Outer Garments | 2385 |
| 86 | 106 | Leather & Sheep-Lined Clothing | 2386 |
| 87 | 107 | Apparel Belts | 2387 |
| 89 | 108 | Apparel, not elsewhere classified | 2389 |
| 91 | 109 | Curtains & Draperies | 2391 |
| 92 | 110 | Housefurnishings, Excluding Curtains & Draperies | 2392 |
| 92 | 111 | Textile Bags | 2393 |
| 94 | 112 | Canvas Products | 2394 |

TABLE C-8 (continued)

| bsolute Number | Title | 1967 SIC |
|---|---|---|
| | MANUFACTURING (Continued) | |
| 113 | Pleating, Decorative & Novelty Stitching & Tucking | 2395 |
| 114 | Apparel Findings & Related Products | 2396 |
| 115 | Schiffli Machine Embroideries | 2397 |
| 116 | Fabricated Textile Products, not elsewhere classified | 2399 |
| 117 | Sawmills & Planing Mills, General | 2421 |
| 118 | Millwork Plants | 2431 |
| 119 | Prefabricated Wooden Buildings & Structural Members | 2433 |
| 120 | Nailed & Lock Corner Wooden Boxes & Shook | 2441 |
| 121 | Veneer & Plywood Containers, Excluding Boxes & Crates | |
| 122 | Cooperage | |
| 123 | Wood Products, not elsewhere classified | 2411, 2426, 2429, 2432, 2442, 2491, 2499 |
| 124 | Wood Household Furniture, Excluding Upholstered | 2511 |
| 125 | Wood Household Furniture, Upholstered | 2512 |
| 126 | Metal Household Furniture | 2514 |
| 127 | Mattresses & Bedsprings | 2515 |
| 128 | Household Furniture, not elsewhere classified | 2519 |
| 129 | Wood Office Furniture | 2521 |

| Number | Title | SIC |
|---|---|---|
| | MANUFACTURING (Continued) | |
| 133 | Metal Partitions, Shelving, Lockers & Office & Store Fixtures | 2542 |
| 134 | Venetian Blinds & Shades | 2591 |
| 135 | Furniture & Fixtures, not elsewhere classified | 2599 |
| 136 | Paper Mills, Excluding Building Paper Mills | 2621 |
| 137 | Paperboard Mills | 2631 |
| 138 | Converted Paper & Paperboard Products, not elsewhere classified | 2644, 2646, 2649 |
| 139 | Paper Coating & Glazing | 2641 |
| 140 | Envelopes | 2642 |
| 141 | Bags, Excluding Textile Bags | 2643 |
| 142 | Die Cut Paper & Paperboard; & Cardboard | 2645 |
| 143 | Sanitary Paper Products | 2647 |
| 144 | Folding Paperboard Boxes | 2651 |
| 145 | Set-Up Paperboard Boxes | 2652 |
| 146 | Corrugated & Solid Fiber Boxes | 2653 |
| 147 | Sanitary Food Containers | 2654 |
| 148 | Fiber Cans, Tubes, Drums, & Similar Products | 2655 |
| 149 | Building Paper & Building Board Mills | 2661 |
| 150 | Newspapers: Publishing, Publishing & Printing | 2711 |
| 151 | Periodicals: Publishing, Publishing & Printing | 2721 |
| 152 | Books: Publishing, Publishing & Printing | 2731 |
| 153 | Book Printing | 2732 |
| 154 | Miscellaneous Publishing | 2741 |
| 155 | Commercial Printing, Excluding Lithographic | 2751 |

TABLE C-8 (continued)

| Sector Code | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | MANUFACTURING (Continued) | |
| 2752 | 156 | Commercial Printing, Lithographic | 2752 |
| 2753 | 157 | Engraving & Plate Printing | 2753 |
| 2761 | 158 | Manifold Business Forms Manufacturing | 2761 |
| 2771 | 159 | Greeting Card Manufacturing | 2771 |
| 2782 | 160 | Blankbooks, Loose-Leaf Binders & Devices | 2782 |
| 2789 | 161 | Bookbinding & Miscellaneous Related Work | 2789 |
| 2791 | 162 | Typesetting | 2791 |
| 2793 | 163 | Photoengraving | 2793 |
| 2794 | 164 | Electrotyping & Stereotyping | 2794 |
| 2799 | 165 | Service Industries for the Printing Trades, not elsewhere classified | 2799 |
| 2813 | 166 | Industrial Gases | 2813 |
| 2815 | 167 | Cyclic Intermediates, Dyes, Organic Pigments and Cyclic Crudes | 2815 |
| 2816 | 168 | Inorganic Pigments | 2816 |
| 2818 | 169 | Industrial Organic Chemicals, not elsewhere classified | 2818 |
| 2819 | 170 | Industrial Inorganic Chemicals, not elsewhere classified | 2819 |
| 2821 | 171 | Plastics Materials, Synthetic Resins & Nonvulcanizable Elastomers | 2821 |
| 2830 | 172 | Drugs | 283 |
| 2841 | 173 | Soap & Other Detergents | 2841 |
| 2842 | 174 | Specialty Cleaning, Polishing & Sanitation | |

| | Number | Title | SIC |
|---|---|---|---|
| | | MANUFACTURING (Continued) | |
| 1 | 177 | Paints, Varnishes, Lacquers, Enamels, & Allied Products | 2851 |
| 1 | 178 | Gum & Wood Chemicals | 2861 |
| 0 | 179 | Agricultural Chemicals | 2879, 2873, 2 |
| 1 | 180 | Fertilizers | 2871 |
| 1 | 181 | Adhesives & Gelatin | 2891 |
| 2 | 182 | Explosives | 2892 |
| 3 | 183 | Printing Ink | 2893 |
| 5 | 184 | Carbon Black | |
| | 185 | Chemicals & Chemical Preparations, not elsewhere classified | 2899 |
| 1 | 186 | Petroleum Refining | 2911 |
| 1 | 187 | Paving & Mixture & Blocks | 2951 |
| 2 | 188 | Asphalt Felts & Coatings | 2952 |
| 2 | 189 | Lubricating Oils & Greases | 2992 |
| 1 | 190 | Tires & Inner Tubes | 3011 |
| 1 | 191 | Rubber Footwear | 3021 |
| 1 | 192 | Reclaimed Rubber | 3031 |
| 9 | 193 | Fabricated Rubber Products, not elsewhere classified | 3069 |
| 9 | 194 | Miscellaneous Plastic Products | 3079 |
| 1 | 195 | Leather Tanning & Finishing | 3111 |
| 1 | 196 | Industrial Leather Belting & Packing | 3121 |
| 1 | 197 | Boot & Shoe Cut Stock & Findings | 3131 |
| 1 | 198 | Footwear, Excluding House Slippers | 3141 |

TABLE C-8 (continued)

| Sector Code | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | MANUFACTURING (Continued) | |
| 3142 | 199 | House Slippers | 3142 |
| 3161 | 200 | Luggage | 3161 |
| 3171 | 201 | Women's Handbags & Purses | 3171 |
| 3172 | 202 | Personal Leather Goods, Excluding Handbags & Purses | 3172 |
| 3199 | 203 | Leather Goods, not elsewhere classified | 3199 |
| 3211 | 204 | Flat Glass | 3211 |
| 3221 | 205 | Glass Containers | 3221 |
| 3229 | 206 | Pressed & Blown Glass Glassware, not elsewhere classified | 3229 |
| 3231 | 207 | Glass Products Made of Purchased Glass | 3231 |
| 3241 | 208 | Cement, Hydraulic | 3241 |
| 3251 | 209 | Brick & Structural Clay Tile | 3251 |
| 3253 | 210 | Ceramic Wall & Floor Tile | 3253 |
| 3255 | 211 | Clay Refractories | 3255 |
| 3259 | 212 | Structural Clay Products, not elsewhere classified | 3259 |
| 3261 | 213 | Vitreous China Plumbing Fixtures | 3261 |
| 3269 | 214 | Pottery Products, not elsewhere classified | 3269 |
| 3271 | 215 | Concrete Brick & Block | 3271 |
| 3272 | 216 | Concrete Products, Excluding Block & Brick | 3272 |
| 3273 | 217 | Ready-Mixed Cement | 3273 |

TABLE 3-3 (Continued)

| Sector Code | Absolute Number | Title | 19 S |
|---|---|---|---|
| | | MANUFACTURING (Continued) | |
| 3293 | 223 | Steam & Other Packing & Pipe & Boiler Covering | 32 |
| 3295 | 224 | Minerals & Earths | 32 |
| 3296 | 225 | Mineral Wool | 32 |
| 3297 | 226 | Nonclay Refractories | 32 |
| 3299 | 227 | Nonmetallic Mineral Products, not elsewhere classified | 32 |
| 3312 | 228 | Blast Furnaces, Steel Works, & Rolling Mills | 33 |
| 3315 | 229 | Steel Wire Drawing & Steel Nails & Spikes | 33 |
| 3316 | 230 | Cold Rolled Sheet, Strip & Bars | 33 |
| 3317 | 231 | Steel Pipe & Tubes | 33 |
| 3321 | 232 | Gray Iron Foundries | 33 |
| 3323 | 233 | Steel Iron Foundries | 33 |
| 3330 | 234 | Primary Smelting & Refining of Nonferrous Metals | 33 |
| 3333 | 235 | Primary Smelting & Refining of Zinc | 33 |
| 3334 | 236 | Primary Production of Aluminum | 33 |
| 3341 | 237 | Secondary Smelting Refining & Alloying of Nonferrous Metals | 33 |
| 3351 | 238 | Rolling, Drawing & Extruding of Copper | 33 |
| 3352 | 239 | Rolling, Drawing & Extruding of Aluminum | 33 |
| 3356 | 240 | Rolling, Drawing & Extruding of Other Nonferrous Metals | 33 |
| 3357 | 241 | Drawing & Insulating of Nonferrous Wire | 33 |
| 3361 | 242 | Aluminum Castings | 33 |
| 3362 | 243 | Brass, Bronze, Copper, Copper Base Alloy Castings | 33 |
| 3369 | 244 | Nonferrous Casting, not elsewhere classified | 33 |

TABLE C-8 (continued)

| ctor ode | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | MANUFACTURING (Continued) | |
| 390 | 245 | Primary Metal Products, not elsewhere classified | 3392, 3399 |
| 391 | 246 | Iron & Steel Forgings | 3391 |
| 411 | 247 | Metal Cans | 3411 |
| 421 | 248 | Cutlery | 3421 |
| 423 | 249 | Hand & Edge Tools, Excluding Machine Tools & Saws | 3423 |
| 25 | 250 | Hand Saws & Saw Blades | 3425 |
| 429 | 251 | Hardware, not elsewhere classified | 3429 |
| 431 | 252 | Enameled Iron & Metal Sanitary Ware | 3431 |
| 432 | 253 | Plumbing Fixture Fittings & Trim | 3432 |
| 433 | 254 | Heating Equipment, Excluding Electric | 3433 |
| 441 | 255 | Fabricated Structural Steel | 3441 |
| 442 | 256 | Metal Doors, Sash, Frames, Molding & Trims | 3442 |
| 443 | 257 | Fabricated Plate Work (Boiler Shops) | 3443 |
| 444 | 258 | Sheet Metal Work | 3444 |
| 449 | 259 | Architectural & Miscellaneous Metal Work | 3446, 3449 |
| 451 | 260 | Screw Machine Products | 3451 |
| 452 | 261 | Bolts, Nuts, Screws, Rivets & Washers | 3452 |
| 461 | 262 | Metal Stampings | 3461 |
| 471 | 263 | Electroplating, Plating, Polishing, Anodizing & Coloring | 3471 |
| 79 | 264 | Coating, Engraving, & Allied Services, not elsewhere classified | 3479 |
| 481 | 265 | Miscellaneous Fabricated Wire Products | 3481 |
| 491 | 266 | Metal Shipping Barrels, Drums, Kegs & Pails | 3491 |

TABLE C-8 (continued)

| Absolute Number | Title | 1967 SIC |
|---|---|---|
| | MANUFACTURING (Continued) | |
| 269 | Collapsible Tubes | 3496 |
| 270 | Metal Foil & Leaf | 3497 |
| 271 | Fabricated Pipe & Fabricated Pipe Fittings | 3498 |
| 272 | Fabricated Metal Products, not elsewhere classified | 3499 |
| 273 | Steam Engines; Steam, Gas, & Hydraulic Turbines; and Steam, Gas, & Hydraulic Turbine Generator Set Units & Other Internal Combustion Engines, not elsewhere classified | 3511, 3519 |
| 274 | Farm Machinery & Equipment | 3522 |
| 275 | Construction Machinery & Equipment | 3531 |
| 276 | Elevators & Moving Stairways | 3534 |
| 277 | Conveyors & Conveying Equipment | 3535 |
| 278 | Hoist, Industrial Cranes & Monorail Systems | 3536 |
| 279 | Industrial Trucks, Tractors, Trailers & Stackers | 3537 |
| 280 | Machine Tools, Metal-Cutting Types | 3541 |
| 281 | Machine Tools, Metal-Forming Types | 3542 |
| 282 | Special Dies & Tools, Die Sets, Jigs & Fixtures | 3544 |
| 283 | Machine Tool Accessories & Measuring Devices | 3545 |
| 284 | Metal-Working Machinery, Excluding Machine Tools | 3548 |
| 285 | Food Products Machinery | 3551 |
| 286 | Textile Machinery | 3552 |
| 287 | Woodworking Machinery | 3553 |
| 288 | Paper Industries Machinery | 3554 |
| 289 | Printing Trades Machinery & Equipment | 3555 |

TABLE C-8 (continued)

| or le | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | MANUFACTURING (Continued) | |
| 9 | 290 | Special Industry Machinery, not elsewhere classified | 3559 |
| 1 | 291 | Pumps, Air & Gas Compressors & Pumping Equipment | 3561 |
| 2 | 292 | Ball & Roller Bearings | 3562 |
| 4 | 294 | Blowers Exhaust & Ventilating Fans | 3564 |
| 5 | 294 | Industrial Patterns | 3565 |
| 6 | 295 | Mechanical Power Transmission Equipment, Excluding Ball and Roller Bearings | 3566 |
| 7 | 296 | Industrial Process Furnaces & Ovens | 3567 |
| 9 | 297 | General Industrial Machinery & Equipment, not elsewhere classified | 3569 |
| 3 | 298 | Electronic Computing Equipment | 3573 |
| 6 | 299 | Scales & Balances, Excluding Laboratory | 3576 |
| 9 | 300 | Office Machines, not elsewhere classified | 3579 |
| 1 | 301 | Automatic Merchandising Machines | 3581 |
| 2 | 302 | Commercial Laundry, Dry Cleaning, & Processing Machines | 3582 |
| 5 | 303 | Refrigerators, Refrigeration Machinery, Excluding Household, & Complete Air-Conditioning Units | 3585 |
| 6 | 304 | Measuring & Dispensing Pumps | 3586 |
| 9 | 305 | Service Industry Machines, not elsewhere classified | 3589 |
| 9 | 306 | Miscellaneous Machinery, Except Electrical | 3599, 3532, 3 |
| 1 | 307 | Electrical Measuring Instr. ... & Test Equipment | 361 |

| Sector Code | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | MANUFACTURING (Continued) | |
| 3621 | 310 | Motors & Generators | 3621 |
| 3622 | 311 | Industrial Controls | 3622 |
| 3623 | 312 | Welding Apparatus | 3623 |
| 3624 | 313 | Carbon & Graphite Products | 3624 |
| 3629 | 314 | Electrical Industrial Apparatus, not elsewhere classified | 3629 |
| 3631 | 315 | Household Cooking Equipment | 3631 |
| 3633 | 316 | Household Laundry Equipment | 3633 |
| 3634 | 317 | Electric Housewares & Fans | 3634 |
| 3635 | 318 | Household Vacuum Cleaners | 3635 |
| 3639 | 319 | Household Appliances, not elsewhere classified | 3639 |
| 3642 | 320 | Lighting Fixtures | 3642 |
| 3643 | 321 | Current-Carrying Wiring Devices | 3643 |
| 3644 | 322 | Noncurrent-Carrying Wiring Devices | 3644 |
| 3651 | 323 | Radio & T.V. Receiving Sets, Excluding Communication Types | 3651 |
| 3652 | 324 | Phonograph Records | 3652 |
| 3661 | 325 | Telephone & Telegraph Apparatus | 3661 |
| 3662 | 326 | Radio & T.V. Transmitting, Signaling & Detection Equipment & Apparatus | 3662 |
| 3672 | 327 | Cathode Ray Picture Tubes | 3672 |
| 3673 | 328 | Transmitting Industrial & Special Purpose Electron Tubes | 3673 |
| 3674 | 329 | Semiconductors & Related Devices | 3674 |
| 3679 | 330 | Electronic Components & Accessories, not elsewhere classified | 3679 |
| 3690 | 331 | Electrical Machinery Equipment & Supplies, not elsewhere classified | 3699, |
| 3691 | 332 | Storage Batteries | 3691 |

TABLE C-8 (continued)

| tor de | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | MANUFACTURING (Continued) | |
| 93 | 333 | X-Ray Apparatus and Tubes | 3693 |
| 94 | 334 | Engine Electrical Equipment | 3694 |
| 11 | 335 | Motor Vehicles | 3711 |
| 13 | 336 | Truck & Bus Bodies | 3713 |
| 14 | 337 | Motor Vehicle Parts & Accessories | 3714 |
| 15 | 338 | Truck Trailers | 3715 |
| 21 | 339 | Aircraft | 3721 |
| 22 | 340 | Aircraft Engines & Engine Parts | 3722 |
| 29 | 341 | Aircraft Parts, Equipment, not elsewhere classified | 3729 |
| 31 | 342 | Ship Building & Repairing | 3731 |
| 32 | 343 | Boat Building & Repairing | 3732 |
| 2 | 344 | Railroad & Street Cars | 3742 |
| 91 | 345 | Trailer Coaches | 3791 |
| 99 | 346 | Transportation Equipment, not elsewhere classified | 3799 |
| 1 | 347 | Engineering, Laboratory, & Scientific & Research Instruments & Associated Equipment | 3811 |
| 21 | 348 | Mechanical Measuring & Controlling Instruments | 3821 |
| 22 | 349 | Automatic Temperature Controls | 3822 |
| 31 | 350 | Optical Instruments & Lenses | 3831 |
| 41 | 351 | Surgical & Medical Instruments & Apparatus | 3841 |
| 42 | 352 | Orthopedic, Prosthetic & Surgical Appliances | 3842 |
| 43 | 353 | Dental Equipment & Supplies | 3843 |
| 61 | 354 | Photographic Equipment & Supplies | 3861 |

TABLE C-8 (continued)

| ctor ode | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | MANUFACTURING (Continued) | |
| 913 | 356 | Lapidary Work & Cutting & Polishing Diamonds | 3913 |
| 914 | 357 | Silverware & Plated Ware | 3914 |
| 31 | 358 | Musical Instruments & Parts | 3931 |
| 41 | 359 | Games & Toys | 3941 |
| 942 | 360 | Dolls | 3942 |
| 949 | 361 | Children's Vehicles, Excluding Bicycles | 3949 |
| 51 | 362 | Pens, Pen Points, Fountain Pens, Ball Point Pens, Mechanical Pencils & Parts | 3951 |
| 952 | 363 | Lead Pencils, Crayons, Artists' Materials | 3952 |
| 953 | 364 | Marketing Devices | 3953 |
| 955 | 365 | Carbon Paper & Inked Ribbons | 3955 |
| 961 | 366 | Costume Jewelry & Costume Novelties, Excluding Precious Metals | 3961 |
| 962 | 367 | Feathers, Plumes, & Artificial Flowers | 3962 |
| 964 | 368 | Needles, Pins, Hooks & Eyes, & Similar Notions | 3964 |
| 991 | 369 | Brooms & Brushes | 3991 |
| 993 | 370 | Signs & Advertising Displays | 3993 |
| 994 | 371 | Morticians' Goods | 3994 |
| 996 | 372 | Linoleum, Asphalted-Felt-Base, and Other Floor Coverings | 3996 |
| 999 | 373 | Manufacturing Industries, not elsewhere classified | 3999, 3851, 3963, 3943 |
| | | TRANSPORTATION, COMMUNICATIONS, ELECTRIC, GAS AND SANITARY SERVICES | |
| 011 | 374 | Railroads | 4011, 4013 |

TABLE C-8 (continued)

| Sector Code | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | **TRANSPORTATION, COMMUNICATIONS, ELECTRIC, GAS AND SANITARY SERVICES (continued)** | |
| 4150 | 377 | Transportation Services, not elsewhere classified | 4020, 413, 4231, |
| 4210 | 378 | Trucking, Local & Long Distance | 421 |
| 4220 | 379 | Public Warehousing | 422 |
| 4400 | 380 | Water Transportation | 44 |
| 4500 | 381 | Air Transportation | 45 |
| Communications | | | |
| 4811 | 382 | Telephone Communication | 4811 |
| 4832 | 383 | Radio Broadcasting | 4832 |
| 4833 | 384 | Television Broadcasting | 4833 |
| 4890 | 385 | Communication Services, not elsewhere classified | 4821, |
| Utilities | | | |
| 4911 | 386 | Electric Companies & Systems | 4961, |
| 4920 | 387 | Gas Companies & Systems | 492 & |
| 4941 | 388 | Water Supply | 4941 |
| 4990 | 489 | Sanitary & Other Utility Systems, not elsewhere classified | 4939, |

| Absolute Number | Title | 1967 SIC |
|---|---|---|
| | WHOLESALE TRADE (continued) | |
| 394 | Paints & Varnishes | 5028 |
| 395 | Chemicals & Allied Products, not elsewhere classified | 5029 |
| 396 | Dry Goods, Piece Goods, & Notions | 5033, 5034 |
| 397 | Apparel & Accessories, Hoisery & Lingerie | 5036, 5037 |
| 398 | Footwear | 5039 |
| 399 | Groceries, General Line | 5041 |
| 400 | Dairy Products | 5043 |
| 401 | Poultry & Poultry Products | 5044 |
| 402 | Confectionery | 5045 |
| 403 | Fish & Sea Foods | 5046 |
| 404 | Meats & Meat Products | 5047 |
| 405 | Fresh Fruits & Vegetables | 5048 |
| 406 | Groceries & Related Products, not elsewhere classified | 5049, 5042 |
| 407 | Farm Products, Raw Materials | 505 |
| 408 | Electrical Apparatus & Equipment, Wiring Supplies, & Construction Materials | 5063 |
| 409 | Electrical Appliances, TV & Radio Sets | 5064 |
| 410 | Electrical Parts & Equipment | 5065 |
| 411 | Hardward | 5072 |
| 412 | Plumbing & Heating Equipment & Supplies | 5074 |
| 413 | Air-Conditioning & Refrigeration Equipment & Supplies | 5077 |
| 414 | Commercial & Industrial Machinery, Equipment, & Supplies | 5082 |
| 415 | Farm Machinery & Equipment | 5083 |
| 416 | Professional Equipment & Supplies | 5086 |
| 417 | Equipment & Supplies for Service Establishments | 5087 |

TABLE C-8 (continued)

| Sector Code | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | WHOLESALE TRADE (continued) | |
| 5089 | 418 | Machinery, Equipment, & Supplies, not elsewhere classified | 5088, |
| 5091 | 419 | Metals & Minerals, Excluding Petroleum & Scrap | 5091 |
| 5092 | 420 | Petroleum & Petroleum Products | 5092 |
| 5093 | 421 | Scrap & Waste Materials | 5093 |
| 5099 | 422 | Miscellaneous Wholesalers, not elsewhere classified | 5094, 5097, |
| | | RETAIL TRADE | |
| 5210 | 423 | Lumber & Other Building Materials Dealers | 5211 |
| 5221 | 424 | Plumbing, Heating, & Air-Conditioning Equipment Dealers | 5221 |
| 5231 | 425 | Paint, Glass, & Wallpaper Stores | 5231 |
| 5241 | 426 | Electrical Supply Stores | 5241 |
| 5250 | 427 | Hardware Stores & Farm Equipment Dealers | 525 |
| 5311 | 428 | Department Stores | 5311 |
| 5331 | 429 | Variety Stores | 5331 |
| 5342 | 430 | Mail Order Houses & Merchandise Vending Machine Operators | 5341 |
| 5351 | 431 | Direct Selling Organizations | 5351 |
| 5399 | 432 | Miscellaneous General Merchandise Stores | 5399 |

| Absolute Number | Title | 1987 SIC |
|---|---|---|
| | RETAIL TRADE (continued) | |
| 436 | Candy, Nut, & Confectionery Stores | 5441 |
| 437 | Retail Bakeries | 546 |
| 438 | Miscellaneous Food Stores, not elsewhere classified | 5451, 5499 |
| 439 | Motor Vehicle Dealers | 5511 |
| 440 | Motor Vehicle Dealers, (used cars only) | 5521 |
| 441 | Tire, Battery, & Accessory Dealers | 5531 |
| 442 | Gasoline Service Stations | 5541 |
| 443 | Miscellaneous Aircraft, Marine & Automotive Dealers | 559 |
| 444 | Men's & Boys' Clothing & Furnishings Stores | 5611 |
| 445 | Women's Ready-to-Wear Stores | 5621 |
| 446 | Women's Accessory & Specialty Stores | 5631 |
| 447 | Children's & Infants' Wear Stores | 5641 |
| 448 | Family Clothing Stores | 5651 |
| 449 | Shoe Stores | 5661 |
| 450 | Miscellaneous Apparel & Accessory Stores, not elsewhere classified | 5671, 5681, 56 |
| 451 | Furniture, Home Furnishings, & Equipment Stores | 571 |
| 452 | Household Appliance Stores | 5722 |
| 453 | Radio, Television, & Music Stores | 573 |
| 454 | Eating Places | 5812 |
| 455 | Drinking Places | 5813 |

TABLE C-8 (continued)

| ctor ode | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | RETAIL TRADE (continued) | |
| 912 | 456 | Drug Stores & Proprietary Stores | 5912 |
| 921 | 457 | Liquor Stores | 5921 |
| 940 | 458 | Book & Stationery Stores | 594 |
| 950 | 459 | Sporting Goods Stores & Bicycle Shops | 595 |
| 971 | 460 | Jewelry Stores | 5971 |
| 980 | 461 | Fuel & Ice Dealers | 598 |
| 990 | 462 | Retail Stores, not elsewhere classified | 593, 596, 59 |
| | | FINANCE, INSURANCE, AND REAL ESTATE | |
| 011 | 463 | Federal Reserve Bank | 6011 |
| 020 | 464 | Commercial & Stock Savings Banks | 602 |
| 030 | 465 | Mutual Savings Banks | 603 |
| 120 | 466 | Savings & Loan Associations | 612 |
| 190 | 467 | Miscellaneous Financial Institutions | 604, 605, 61 614, 615, 61 |
| 200 | 468 | Security & Commodity Brokers, Dealers, Exchanges, & Services | 62 |
| 301 | 469 | Non-Life Insurance Carriers | 632 pt, 633, 636, 639 |
| 310 | 470 | Life Insurance Carriers | 631, 632 pt |

| Absolute Number | Title | 1967 SIC |
|---|---|---|
| | SERVICES | |
| 473 | Hotel, Personal, & Repair Services | 70, 72, 76 (exc 7694, 7699) |
| 474 | Business Services, Excluding Advertising | 6541, 73 (exc. 7391) 7694, 769 |
| 475 | Advertising Services | 81, 89 (exc. 89 731 |
| 476 | Research & Development, Educational & Scientific Research Agencies | 7391, 8921 |
| 477 | Automobile Repair, Services & Garages | 75 |
| 478 | Amusement & Recreational Services | 78, 79 |
| | MEDICAL, EDUCATIONAL, NON-PROFIT | |
| 479 | Hospitals | 8061 |
| 480 | Medical & Health Services, not elsewhere classified | 80 (exc. 8061), 0722 |
| 481 | Elementary & Secondary Schools | 8211 |
| 482 | Institutions of Higher Education | 822 |

TABLE C-8 (continued)

| or le | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | MEDICAL, EDUCATIONAL, NON-PROFIT (continued) | |
| 90 | 483 | Other Educational Services, not elsewhere classified | 823, 824, 829 |
| 86 | 484 | Non-Profit Membership Organizations, Museums, Art Galleries, Botanical & Zoological Gardens | 84, 86 |
| 00 | 485 | Private Household Services | 88 |
| | | GOVERNMENT, HOUSEHOLDS, & MISCELLANEOUS | |
| 00 | 486 | Local Government, Excluding Water Utilities and Education | 93 |
| 76 | 487 | Office Supplies Allocator | (NA) |
| 82 | 488 | Transportation Services Allocator | (NA) |
| 88 | 489 | Households | (NA) |
| 99 | 490 | Nonclassifiable Industries | 9999 |
| SECTORS WHICH APPEAR ONLY AS ROWS, NOT AS COLUMNS | | | |
| 011 | 491 | Iron Ores | 1011 |
| 021 | 492 | Copper Ores | 1021 |

| or de | Absolute Number | Title | 1987 SIC |
|---|---|---|---|
| | | GOVERNMENT, HOUSEHOLDS, & MISCELLANEOUS (continued) | |
| 093 | 497 | Titanium Ores | 1093 |
| 099 | 498 | Metal Ores, not elsewhere classified | 1099 |
| 00 | 499 | Anthracite Mining | 1100 |
| 311 | 500 | Crude Petroleum and Natural Gas | 1311 |
| 453 | 501 | Fire Clay | 1453 |
| 455 | 502 | Kaolin and Ball Clay | 1455 |
| 459 | 503 | Clay and Related Materials, not elsewhere classified | 1459 |
| 470 | 504 | Chemical and Fertilizer Minerals | 1470 |
| 023 | 505 | Condensed and Evaporated Milk | 2023 |
| 044 | 506 | Rice Milling | 2044 |
| 061 | 507 | Raw Cane Sugar | 2061 |
| 083 | 508 | Malt | 2083 |
| 91 | 509 | Cottonseed Oil Mills | 2091 |
| 092 | 510 | Soybean Oil Mills | 2092 |
| 141 | 511 | Tobacco Stemming and Redrying | 2141 |
| 96 | 512 | Tire Cord and Fabric | 2296 |

TABLE C-8 (continued)

| Sector Code | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | GOVERNMENT, HOUSEHOLDS, & MISCELLANEOUS (continued) | |
| * 2442 | 513 | Wirebound Boxes and Crates | 2442 |
| * 2611 | 514 | Pulp Mills | 2611 |
| * 2812 | 515 | Alkalies and Chlorine | 2812 |
| * 2822 | 516 | Synthetic Rubber | 2822 |
| * 2823 | 517 | Cellulose Man-Made Fibers | 2823 |
| * 2824 | 518 | Synthetic Organic Fibers | 2824 |
| * 2833 | 519 | Medicinals and Botanicals | 2833 |
| * 2999 | 520 | Petroleum and Coal Products, not elsewhere classified | 2999 |
| * 3151 | 521 | Leather Gloves and Mittens | 3151 |
| * 3262 | 522 | Vitreous Table and Kitchenware | 3262 |
| * 3263 | 523 | Fine Eartherware Food Utensils | 3263 |
| * 3264 | 524 | Porcelain Electrical Supplies | 3264 |
| * 3313 | 525 | Electrometallurgical Products | 3313 |

| ode | Number | Title | SIC |
|---|---|---|---|
| | | GOVERNMENT, HOUSEHOLDS, & MISCELLANEOUS (continued) | |
| 3572 | 528 | Typewriters | 3572 |
| 3584 | 529 | Industrial Vacuum Cleaners | part 3589 |
| 3632 | 530 | Household Refrigerators and Freezers | 3632 |
| 3636 | 531 | Sewing Machines | 3636 |
| 3641 | 532 | Electric Lamps | 3641 |
| 3671 | 533 | Electron Tubes, Receiving Type | 3671 |
| 692 | 534 | Primary Batteries, Dry and Wet | 3692 |
| 3723 | 535 | Aircraft Propellers and Parts | 3723 |
| 3741 | 536 | Locomotives and Parts | 3741 |
| 3751 | 537 | Motocycles, Bicycles and Parts | 3751 |
| 3851 | 538 | Opthalmic Goods | 3851 |
| 3871 | 539 | Watches, Clocks and Watchcases | 3871 |
| 3943 | 540 | Childrens' Vehicles, Excluding Bicycles | 3943 |
| 6510 | 541 | Real Estate Operators and Lessors | 6510 |
| 9100 | 542 | Federal Taxes | (NA) |
| 9102 | 543 | U.S. Post Office | (NA) |

TABLE C-8 (continued)

| tor de | Absolute Number | Title | 1967 SIC |
|---|---|---|---|
| | | GOVERNMENT, HOUSEHOLDS, & MISCELLANEOUS (continued) | |
| 200 | 544 | State Taxes | (NA) |
| 522 | 545 | Scrap Textile Products | (NA) |
| 524 | 546 | Scrap Lumber Products | (NA) |
| 526 | 547 | Scrap Paper Products | (NA) |
| 530 | 548 | Scrap Rubber Products | (NA) |
| 533 | 549 | Scrap Ferrous Metal Products | (NA) |
| 534 | 550 | Scrap Nonferrous Metal Products | (NA) |
| 538 | 551 | Scrap Steel Drums | (NA) |
| 891 | 552 | Net Profit | (NA) |
| 892 | 553 | Capital Allowance | (NA) |
| 893 | 554 | Employee Fringe Benefits | (NA) |

The 90-Order aggregate sector number, for investment and employme
follows the sector title. The 4-digit SIC codes are those used fo
1967 census of manufactures. A code ending with a '0' designates
entire 3-digit group; a code ending with '00' designates an entir
2-digit group. A minus sign indicates that this SIC is excluded f
the sector.

| | Sector Titles | 90-Order | Standard Industrial Classifica | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Dairy farm products | ( 1) | 132 | | | | |
| 2 | Poultry and eggs | ( 1) | 133 | | | | |
| 3 | Meat animals, oth livestk | ( 1) | 135 | 136 | 139 | 193 | |
| 4 | Cotton | ( 1) | 112 | | | | |
| 5 | Grains | ( 1) | 113 | | | | |
| 6 | Tobacco | ( 1) | 114 | | | | |
| 7 | Fruit, vegetbs, oth crops | ( 1) | 119 | 120 | 192 | | |
| 8 | Forestry | ( 1) | 810 | 820 | 840 | 860 | 9 |
| 9 | Fishery products | ( 1) | 074 | | | | |
| 10 | Agr, forestry & fish serv. | ( 1) | 710 | 720 | 730 | 850 | 9 |
| 11 | Iron ores | ( 2) | 1010 | 1060 | | | |
| 12 | Copper ore | ( 2) | 1020 | | | | |
| 13 | Other non-ferrous ores | ( 2) | 1030 | 1050 | 1090 | | |
| 14 | Coal mining | ( 2) | 1110 | 1210 | | | |
| 15 | Crude petrolum, nat. gas | ( 3) | 1310 | 1320 | | | |
| 16 | Empty | | | | | | |
| 17 | Stone and clay mining | ( 2) | 1410 | 1420 | 1440 | 1450 | 14 |
| 18 | Chemical fertilizer mining | ( 2) | 1470 | | | | |
| 19 | New construction | ( 4) | 1600 | | | | |
| 20 | Maintenance construction | ( 0) | 1500 | | | | |
| 21 | Complete guided missiles | ( 5) | 1925 | | | | |
| 22 | Ammunition | ( 5) | 1929 | 1960 | | | |
| 23 | Other ordnance | ( 5) | 1910 | 1930 | 1940 | 1950 | 19 |
| 24 | Meat products | ( 6) | 2010 | | | | |
| 25 | Dairy products | ( 7) | 2020 | | | | |
| 26 | Canned and frozen foods | ( 8) | 2030 | | | | |
| 27 | Grain mill products | ( 9) | 2040 | | | | |
| 28 | Bakery products | (10) | 2050 | | | | |
| 29 | Sugar | (11) | 2060 | | | | |
| 30 | Confectionery products | (12) | 2070 | | | | |
| 31 | Alcoholic beverages | (13) | 2082 | 2083 | 2084 | 2085 | |
| 32 | Soft drinks and flavorings | (13) | 2086 | 2087 | | | |
| 33 | Fats and oils | (14) | 2091 | 2092 | 2093 | 2094 | 20 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Tobacco producta | (15) | 2110 | 2120 | 2130 | 2140 | |
| Broad and narrow fabrics | (16) | 2210 | 2220 | 2230 | 2240 | 2261 |
| Yarn, thread, finishing | (16) | 2269 | 2280 | | | |
| Floor coveringa | (17) | 2270 | | | | |
| Misc textiles | (18) | 2290 | | | | |
| Knitting | (19) | 2250 | | | | |
| Apparel | (20) | 2310 | 2320 | 2330 | 2340 | 2350 |
| | | 2380 | 3992 | | | |
| Household textiles | (21) | 2390 | | | | |
| Logging camps | (22) | 2410 | | | | |
| Saw and planing mills | (22) | 2420 | | | | |
| Veneer and plywood | (23) | 2432 | | | | |
| Millwork and wood products | (23) | 2431 | 2433 | 2490 | | |
| Wooden containers | (24) | 2440 | | | | |
| Household furniture | (25) | 2510 | | | | |
| Other furniture | (25) | 2520 | 2530 | 2540 | 2590 | |
| Pulp mills | (25) | 2610 | | | | |
| Paper and paperboard mills | (27) | 2620 | 2630 | | | |
| Paper products, NEC | (27) | 2641 | 2642 | 2643 | 2645 | 2646 |
| Wall and building paper | (27) | 2644 | 2660 | | | |
| Paperboard containers | (28) | 2650 | | | | |
| Newspapers | (29) | 2710 | | | | |
| Periodicals | (30) | 2720 | | | | |
| Books | (30) | 2730 | | | | |
| Business forms, blank books | (30) | 2760 | 2782 | | | |
| Commercial printing | (30) | 2751 | 2752 | | | |
| Other printing, publishing | (30) | 2740 | 2753 | 2770 | 2789 | 2790 |
| Empty | | | | | | |
| Empty | | | | | | |
| Empty | | | | | | |
| Industrial chemicals | (31) | 2810 | | | | |
| Fertilizers | (32) | 2871 | 2872 | | | |
| Pesticides & agric. chem. | (32) | 2879 | | | | |
| Misc chemical products | (33) | 2860 | 2890 | | | |
| Plastic mat'ls. & reains | (34) | 2821 | | | | |
| Synthetic rubber | (34) | 2822 | | | | |
| Celluloaic fibers | (34) | 2823 | | | | |
| Non-cellulosic fibers | (34) | 2824 | | | | |
| Drugs | (35) | 2830 | | | | |
| Cleaning & toilet products | (36) | 2840 | | | | |
| Paints | (37) | 2850 | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | Empty | | | | | | |
| 6 | Petroleum refining[1] | (38) | 2911 | 2990 | | | |
| 7 | Fuel oil [1] | (38) | 2911 | | | | |
| 8 | Paving and asphalt | (38) | 2950 | | | | |
| 9 | Empty | | | | | | |
| 0 | Tires and inner tubes | (39) | 3010 | | | | |
| | Rubber products | (40) | 3020 | 3030 | 3060 | | |
| 2 | Misc plastic products | (41) | 3070 | | | | |
| 3 | Leather & ind lthr products | (42) | 3110 | 3120 | | | |
| 4 | Footwear (fxc. rubber) | (43) | 3130 | 3140 | | | |
| 5 | Other leather products | (43) | 3150 | 3160 | 3170 | 3190 | |
| 6 | Glass | (44) | 3210 | 3220 | 3230 | | |
| 7 | Structural clay products | (45) | 3250 | | | | |
| 8 | Pottery | (45) | 3260 | | | | |
| 9 | Cement, concrete, gypsum | (45) | 3240 | 3270 | | | |
| 0 | Other stone & clay products | (45) | 3280 | 3290 | | | |
| | Steel | (46) | 3310 | 3320 | 3391 | 3399 | |
| 2 | Copper | (47) | 3331 | 3340 | 3351 | 3362 | |
| 3 | Lead | (47) | 3332 | | | | |
| 4 | Zinc | (47) | 3333 | | | | |
| 5 | Aluminum | (47) | 3334 | 3352 | 3361 | | |
| 6 | Oth prim non-fer metals | (47) | 3339 | | | | |
| 7 | Oth non-fer roll & draw | (47) | 3356 | | | | |
| 8 | Non-ferrous wire drawing | (47) | 3357 | | | | |
| | Non-fer casting & forging | (47) | 3369 | 3392 | | | |
| 0 | Metal cans | (48) | 3410 | | | | |
| 1 | Metal barrels and drums | (48) | 3491 | | | | |
| 2 | Plumbing & heating equip. | (49) | 3430 | | | | |
| 3 | Boiler shops | (50) | 3443 | | | | |
| 4 | Oth structural metal prod. | (50) | 3441 | 3442 | 3444 | 3446 | 3449 |
| 5 | Screw machine products | (51) | 3450 | | | | |
| 6 | Metal stampings | (51) | 3460 | | | | |
| 7 | Cutlery, hand tools, hardwr | (52) | 3420 | | | | |
| 8 | Misc fabricated wire prod. | (52) | 3480 | | | | |
| 9 | Pipes, valves, fittings | (52) | 3494 | 3498 | | | |

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ector 76 shows shipments of all petroleum refining. However, all fuel
l is sold to sector 77; therefore, the sales to other sectors show
rchsses of gasoline, aviation fuel, and petrochemical feedstocks. The
stribution of sales for sector 77 shows purchases of residual and
stillate fuel oil, diesel fuel, and kerosene.

| | | | | | | |
|---|---|---|---|---|---|---|
| 111 | Engines and turbines | (53) | 3510 | | | |
| 112 | Farm machinery | (54) | 3520 | | | |
| 113 | Constr, mine, oilfield mach | (55) | 3531 | 3532 | 3533 | |
| 114 | Materials handling mach. | (55) | 3534 | 3535 | 3536 | 3537 |
| 115 | Mach. tools, metal cutting | (56) | 3541 | | | |
| 116 | Mach. tools, metal forming | (56) | 3542 | | | |
| 117 | Other metal working mach. | (56) | 3544 | 3545 | 3548 | |
| 118 | Special industrial mach. | (57) | 3550 | | | |
| 119 | Pumps, compressors, blowers | (58) | 3561 | 3564 | | |
| 120 | Ball and roller bearings | (58) | 3562 | | | |
| 121 | Power transmission equip. | (58) | 3566 | | | |
| 122 | Industrial patterns | (58) | 3565 | 3567 | 3569 | |
| 123 | Computers & related mach. | (60) | 3571 | 3573 | 3574 | |
| 124 | Other office machinery | (60) | 3572 | 3576 | 3579 | |
| 125 | Service industry machinery | (61) | 3580 | | | |
| 126 | Machine shop products | (59) | 3590 | | | |
| 127 | Empty | | | | | |
| 128 | Empty | | | | | |
| 129 | Elec. measuring instrument | (62) | 3611 | | | |
| 130 | Transformers & switchgear | (62) | 3612 | 3613 | | |
| 131 | Motors and generators | (63) | 3621 | | | |
| 132 | Industrial controls | (63) | 3622 | | | |
| 133 | Welding app. graphite prod. | (63) | 3623 | 3624 | 3629 | |
| 134 | Household appliances | (64) | 3630 | | | |
| 135 | Elec. lighting & wiring eq. | (65) | 3640 | | | |
| 136 | Radio and TV receiving | (66) | 3651 | | | |
| 137 | Phonograph records | (66) | 3652 | | | |
| 138 | Communication equipment | (67) | 3660 | | | |
| 139 | Electronic components | (68) | 3670 | | | |
| 140 | Batteries | (69) | 3691 | 3692 | | |
| 141 | Engine electrical equipment | (69) | 3694 | | | |
| 142 | X-ray, elec. equip, NEC | (69) | 3693 | 3699 | | |
| 143 | Empty | | | | | |
| 144 | Truck, bus, trailer bodiea | (70) | 3713 | 3715 | | |
| 145 | Motor vehicles | (70) | 3711 | 3714 | 3717 | |
| 146 | Empty | | | | | |
| 147 | Aircraft | (71) | 3721 | | | |
| 148 | Aircraft engines | (71) | 3722 | | | |
| 149 | Aircraft equipment, NEC | (71) | 3723 | 3729 | | |
| 150 | Ship and boat building | (72) | 3730 | | | |
| 151 | Railroad equipment | (73) | 3740 | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 153 | Trailer coaches | (74) | 3791 | | | | |
| 154 | Empty | | | | | | |
| 155 | Empty | | | | | | |
| 156 | Engr. & scientific instr. | (75) | 3810 | | | | |
| 157 | Mech. measuring devices | (76) | 3820 | | | | |
| 158 | Optical & ophthalmic goods | (78) | 3830 | 3850 | | | |
| 159 | Medical & surgical instr. | (77) | 3840 | | | | |
| 160 | Photographic equipment | (78) | 3860 | | | | |
| 161 | Empty | | | | | | |
| 162 | Watches and clocks | (78) | 3870 | | | | |
| 163 | Jewelry and silverware | (79) | 3910 | 3961 | | | |
| 164 | Toys, sport, musical instr. | (79) | 3930 | 3940 | | | |
| 165 | Office supplies | (79) | 3950 | | | | |
| 166 | Misc manufacturing, NEC | (79) | 3962 | 3963 | 3964 | 3980 | |
| | | | 3994 | 3995 | 3996 | 3999 | |
| 167 | Railroads | (80) | 4000 | 4740 | | | |
| 168 | Buses and local transit | (82) | 4100 | | | | |
| 169 | Trucking | (81) | 4200 | 4730 | | | |
| 170 | Water transportation | (82) | 4400 | | | | |
| 171 | Airlines | (83) | 4500 | | | | |
| 172 | Pipelines | (82) | 4600 | | | | |
| 173 | Freight forwarding | (82) | 4700 | -4730 | -4740 | | |
| 174 | Telephone and telegraph | (85) | 4800 | -4830 | | | |
| 175 | Radio and TV broadcasting | (85) | 4830 | | | | |
| 176 | Electric utilities | (87) | 4910 | 4930 | | | |
| 177 | Empty | | | | | | |
| 178 | Natural gas | (88) | 4920 | 4930 | | | |
| 179 | Water and sewer services | (88) | 4930 | 4940 | 4950 | 4960 | |
| 180 | Wholesale trade | (84) | 5000 | | | | |
| 181 | Retail trade | (84) | 5200 | 5300 | 5400 | 5500 | |
| | | | 5800 | 5960 | 7390 | | |
| 182 | Banks, credit agen., brokers | (86) | 6000 | 6100 | 6200 | 6700 | |
| 183 | Insurance | (86) | 6300 | | | | |
| 184 | Owner-occupied dwellings | ( 0) | 6400 | | | | |
| 185 | Real estate | (86) | 6500 | 6600 | -6561 | | |
| 186 | Hotel and lodging places | (86) | 7000 | | | | |
| 187 | Personal & repair services | (86) | 7200 | 7600 | -7692 | -7694 | |
| 188 | Business services | (86) | 7300 | 7692 | 8100 | 8900 | |
| | | | -8921 | | | | |
| 189 | Advertising | (86) | 7310 | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 191 | Movies & amusements | (86) | 7800 | 7900 | | |
| 192 | Medical services | (86) | 0722 | 8010 | 8020 | 8030 |
| | | | 8070 | 8090 | | |
| 193 | Private schools & NPO | (86) | 8200 | 8400 | 8600 | 8921 |
| 194 | Post office | | | | | |
| 195 | Fed and S&L Gov. enterprises | | | | | |
| 196 | Non-competitive imports | | | | | |
| 197 | Business travel (dummy) | | | | | |
| 198 | Office supplies (dummy) | | | | | |
| 199 | Unimportant ind. (dummy) | | | | | |
| 200 | Computer rental (dummy) | | | | | |

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planning issues.

There are three principal components to the methodology: generic economies, defining representative technologies, and ca component proportions. Background for each of these topics, as appropriate methodology is presented below:

## 1.0 Delineation of Generic Economies

### 1.1 Background

A final demand change in a local economy will produce effect, the level of which will vary with the industrial struct economy. Multiplier estimation, then, must be undertaken withi of a given industrial structure. Since this paper is taking a tive, the task becomes one of aggregating local area informatio level. The aggregation, however, must be achieved in a manner regional industrial structure that reasonably depicts the quali economies being aggregated. On this basis generic regional eco formed as outlined below.

### 1.2 Methodology

- Divide the national economy into two categories: Sta Metropolitan Statistical Areas (SMSA's) and non-SMSA BEA economic areas (see figure 3 in section I of the map of BEA economic areas);

- Subdivide the above two categories into large and sma on employment levels; and

- Subdivide the above four areas according to geographi and rates of employment growth over the period 1971-1

The size of a multiplier impact in a local economy is de
only by the local industrial structure but also by the
ments of the activity initiating the local economic pert
Varying input requirements will engender varying impacts
equal economies. In order to allow for this aspect of
estimation, input requirements for conventional and sola
were assembled. Three technologies from this set were
represent a range of possible energy technology alternat
selected technologies are representative of the input re
three general types of energy technology alternatives:
conventional electric generation facilities; centralized
generation facilities;** solar collector facilities. Th
type of facilities not represented in this scheme are bi
ties. The input requirements for these facilities were
that no one technology represented them well. Research
plier impact associated with biomass technologies should
on a case by case basis as generalizations from a single
be misleading. Inputs for centralized wood-fired steam
however, to be similar to those for the technologies unc
ized conventional electric generation facilities." Simi
are applicable to passive solar technologies. An approp
in the case of passive might be to examine input require
residential or commercial building construction. The me
choosing the three representative technologies is outlin
This methodology also yields the direct component of the
multiplier.

---

*See exhibit E-1 for a more detailed listing of the representative

**It should be noted, however, that solar thermal electric plants
similar in input requirements to the centralized conventional elec
than to wind energy conversion systems (WECS).

- Group technologies qualitatively (i.e., centralized c centralized solar, decentralized solar);

- Regress the input requirements of each technology in the input requirements of the other technologies in t

- Use the values of the coefficients of determination d the regressions to decide which technology in each gr representative of all technologies in the group; and

- Screen the technologies chosen on the basis of the re analysis to ensure wide geographic applicability and implementation probability.

0 Calculation of the Indirect Component of Regional Multipliers

3.1 Background

The indirect component of the multiplier is estimated on of research conducted by the BEA/RIMS staff. This resea an equation which estimates the indirect component as a the direct component and several variables describing th structure of the impact region. The methodology for thi is outlined below.

3.2 Methodology

- Assemble the data needed to estimate the indirect com regional multipliers via the BEA/RIMS methodology;*

---

$$I_j = e^{B_i (D_j^t)^{1.103}}$$

ere

$I_j^t$ = indirect input of the multiplier associated with the $t^{th}$ te

$B_i$ = a combination of the several variables describing the struc $i^{th}$ region

$D_j^t$ = the $j^{th}$ direct input of the multiplier associated with the

$S_2^r$ = the regional total non-government esrnings pr
of U.S. total non-government earnings in the

$D_j^t$ = the $j^{th}$ input requirement of the $t^{th}$ technolo

k = the parameter associated with the $K^{th}$ variabl
RIMS multiplier estimation equation

- Combine the region and technology specific data with t
parameters in the manner indicated by the RIMS specifi
derive estimates of the indirect component of regional
associated with a given technology; and

- Use $D_j^t$ and $I_j^t$ to derive the direct component proportio
impact technology for the regiona delineated in (1) ab

| TECHNOLOGIES | COST CALCULATION |
|---|---|
| 1. Centralized Conventional Energy Technologies | |
| Coal-fired Steam Electric | Strategic Environmenta |
| Oil-fired Steam Electric* | System, Working Paper |
| Gas-fired Steam Electric | for the Energy Investm |
| Nuclear Reactor | Module |
| 2. Solar Collector Technologies | |
| SHACOB Active System | MITRE Corporation, Sys |
| | and Engineering Cost |
| | Technologies, Vol. II |
| AIPH Flat Plate Hot Water System | Ibid., Vol. III, pp. |
| AIPH Parabolic Trough Steam System* | Ibid., Vol. III, pp. |
| AIPH Parabolic Dish Total Energy System | Ibid., Vol. III, p. 6 |
| Residential Photovoltaics | Ibid., Vol. VIII, pp. |
| Centralized Photovoltaics | Ibid., Vol. VIII, pp. |
| • Centralized Wind Energy Conversion System* | Ibid., Vol. VI, p. 8 |

$S_2^r$ = the regional total non-government earnings pro
of U.S. total non-government earnings in the r

$D_j^t$ = the $j^{th}$ input requirement of the $t^{th}$ technolog

$k$ = the parameter associated with the $K^{th}$ variable
RIMS multiplier estimation equation

- Combine the region and technology specific data with th
parameters in the manner indicated by the RIMS specific
derive estimates of the indirect component of regional
associated with a given technology; and

- Use $D_j^t$ and $I_j^t$ to derive the direct component proportion
impact technology for the regiona delineated in (1) abo

| | |
|---|---|
| Technologies | |
| Coal-fired Steam Electric | Strategic Environme |
| Oil-fired Steam Electric* | System, Working Pap |
| Gas-fired Steam Electric | for the Energy Inve |
| Nuclear Reactor | Module |
| 2. Solar Collector Technologies | |
| SHACOB Active System | MITRE Corporation, |
| | and Engineering Cos |
| | Technologies, Vol. |
| AIPH Flat Plate Hot Water System | Ibid., Vol. III, pp. |
| AIPH Parabolic Trough Steam System* | Ibid., Vol. III, pp. |
| AIPH Parabolic Dish Total Energy System | Ibid., Vol. III, p. |
| Residential Photovoltaics | Ibid., Vol. VIII, p |
| Centralized Photovoltaics | Ibid., Vol. VIII, p |
| 3. Centralized Wind Energy Conversion System* | Ibid., Vol. VI, p. |

*Indicates a representative technology.

| | | | | |
|---|---|---|---|---|
| 065 | Akron, OH | S | ENC | 266,564 |
| 040 | Albany, GA | S | SE | 45,952 |
| 007 | Albany-Schenectady-Troy, NY | L | NE | 339,491 |
| 160 | Albuquerque, NM | S | Mtn | 174,123 |
| 117 | Alexander, LA | S | WSC | 55,517 |
| 018 | Allentown-Bethlehem-Easton, PA-NJ | S | NE | 274,344 |
| 016 | Altoona, PA | S | NE | 55,569 |
| 135 | Amarillo, TX | S | WSC | 77,108 |
| 180 | Anaheim-Santa Ana-Garden Grove, CA@ | L | Pac. | 688,317 |
| 182 | Anchorage, AK@ | S | Pac. | 94,480 |
| 078 | Anderson, IN@ | S | WSC | 58,275 |
| 071 | Ann Arbor, MI | S | WNC | 131,283 |
| 049 | Anniston, AL | S | SE | 51,584 |
| 094 | Appleton-Oahkosh, WI | S | ENC | 131,400 |
| 030 | Asheville, NC | S | SE | 77,427 |
| 036 | Atlanta, GA | L | SE | 896,499 |
| 018 | Atlantic City, NJ | S | NE | 79,538 |
| 035 | Augusta, GA-SC | S | SE | 137,900 |

| | | | | |
|---|---|---|---|---|
| 179 | Bakersfield, CA | S | Pac | 164,179 |
| 019 | Baltimore, MD | L | SE | 968,090 |
| 114 | Baton Rouge, LA@ | S | WSC | 183,876 |
| 074 | Battle Creek, MI | S | WNC | 75,752 |
| 072 | Bay City, MI@ | S | WNC | 39,294 |
| 121 | Beaumont-Port Arthur-Orange, TX | S | WSC | 152,433 |
| 155 | Billings, MT | S | Mtn | 48,970 |
| 113 | Biloxi-Gulfport, MS | S | SE | 76,227 |
| 011 | Binghamton, NY-PA | S | NE | 122,983 |
| 049 | Birmingham, AL | L | SE | 364,203 |
| 079 | Bloomington, IN | S | ENC | 40,856 |
| 087 | Bloomington-Normal, IL | S | ENC | 53,180 |
| 167 | Boise City, ID | S | Mtn | 75,419 |
| 004 | Boston-Lowell-Brockton-Lawrence-Haverhill, MA-NH | L | N.Eng. | 1,781,045 |
| 044 | Bradenton, FL@ | S | SE | 40,609 |
| 012 | Bridgeport-Stamford-Norwalk-Danbury, CT | L | NE | 345,532 |

| | | | | |
|---|---|---|---|---|
| 131 | Brownsville-Harlingen-San Benito, TX | S | WSC | 61,903 |
| 122 | Bryan-College Station, TX | S | WSC | 32,236 |
| 010 | Buffalo, NY@ | L | NE | 532,816 |
| 003 | Burlington, VT | S | NE | 51,522 |
| 028 | Burlington, NC@ | S | SE | 46,993 |
| 065 | Canton, OH | S | ENC | 162,717 |
| 100 | Cedar Rapids, IA | S | WNC | 82,088 |
| 084 | Champaign-Urbana-Rantoul, IL | S | ENC | 81,050 |
| 034 | Charleston-North Charleston, SC | S | SE | 169,249 |
| 060 | Charleston, WV | S | SE | 118,414 |
| 029 | Charlotte-Gastonia, NC | L | SE | 322,886 |
| 051 | Chattanooga, TN-GA | S | SE | 184,493 |
| 156 | Cheyenne, WY | S | Mtn | 33,442 |
| 083 | Chicago, IL | L | ENC | 3,294,038 |
| 067 | Cincinnati, OH-KY-IN | L | ENC | 602,393 |
| 054 | Clarksville-Hopkinaville, TN-KY@ | S | SE | 74,496 |
| 065 | Cleveland, OH | L | ENC | 932,681 |

| | | | | |
|---|---|---|---|---|
| 158 | Colorado Springs, CO | S | Mtn | 130 |
| 106 | Columbia, MO | S | WNC | 47 |
| 032 | Columbia, SC | S | SE | 187 |
| 037 | Columbus, GA-AL[@] | S | SE | 108 |
| 066 | Columbus, OH | L | ENC | 489 |
| 130 | Corpus Christi, TX | S | WSC | 124 |
| 125 | Dallas-Fort Worth, TX | L | WSC | 1,288 |
| 099 | Davenport-Rock Island-Moline, IA-IL | S | ENC/WNC | 180 |
| 068 | Dayton, OH | L | ENC | 380 |
| 042 | Daytona Beach, FL | S | SE | 74 |
| 085 | Decatur, IL | S | ENC | 61 |
| 157 | Denver-Boulder, CO | L | Mtn | 717 |
| 104 | Des Moines, IA | S | WNC | 187 |
| 071 | Detroit, MI | L | ENC | 1,788 |
| 098 | Dubuque, IA | S | WNC | 47 |
| 095 | Duluth-Superior, MN-WI | S | ENC/WNC | 115 |
| 092 | Eau Claire, WI | S | ENC | 51 |
| 133 | El Paso, TX | S | WSC | 173 |
| 011 | Elmira, NY[@] | S | NE | 40 |

| Economic Area Number | Region | Size* | Location** | 1970 Employment |
|---|---|---|---|---|
| 015 | Erie, PA | S | NE | 120,523 |
| 173 | Eugene-Springfield, OR | S | Pac | 100,104 |
| 080 | Evansville, IN-KY | S | ENC/SE | 135,973 |
| 149 | Fargo-Moorhead, ND-MN | S | WNC | 68,508 |
| 026 | Fayetteville, NC | S | SE | 112,809 |
| 109 | Fayetteville-Springdale, AR | S | WSC | 69,671 |
| 071 | Flint, MI | S | ENC | 196,955 |
| 050 | Florence, AL | S | SE | 51,048 |
| 157 | Fort Collins, CO | S | Mtn | 49,239 |
| 043 | Fort Lauderdale-Hollywood, FL | S | SE | 288,478 |
| 044 | Fort Myers, FL@ | S | SE | 52,662 |
| 110 | Fort Smith, AR-OK | S | WSC | 77,263 |
| 076 | Fort Wayne, IN | S | ENC | 185,324 |
| 179 | Fresno, CA | S | Pac | 220,822 |
| 049 | Gadsden, AL@ | S | SE | 35,043 |
| 041 | Gainesville, FL | S | SE | 61,941 |
| 122 | Galveston-Texas City, TX | S | WSC | 75,623 |
| 083 | Gary-Hammond-East Chicago, IN | S | ENC | 261,260 |

| | | | | |
|---|---|---|---|---|
| Grand Rapids, MI | S | ENC | 260,052 | 2.437 |
| Great Falls, Ml | S | Mtn | 38,930 | 1.807 |
| Greeley, CO | S | Mtn | 45,250 | 5.904 |
| Green Bay, WI | S | ENC | 76,316 | 3.216 |
| Greensboro-Winston Salem-High Point, NC | L | SE | 406,426 | 1.634 |
| Greenville-Spartanburg, SC | S | SE | 258,073 | 2.638 |
| Hamilton-Middleton, OH | S | ENC | 86,517 | 1.071 |
| Harrisburg, PA | S | NE | 225,613 | 1.796 |
| Hartford-New Britain-Bristol, CT | L | NE | 511,088 | 1.273 |
| Honolulu, HI | L | Pac | 373,277 | 2.219 |
| Houston, TX[@] | L | WSC | 1,217,678 | 5.656 |
| Huntington-Ashland, WV-KY-OH | S | ENC | 113,079 | 1.018 |
| Huntsville, AL | S | SE | 126,770 | 1.406 |
| Indianapolis, IN | L | ENC | 545,634 | 1.501 |
| Jackson, MI | S | ENC | 58,105 | 0.854 |
| Jackson, MS | S | ESC | 149,841 | 2.980 |
| Jacksonville, FL | L | SE | 315,057 | 2.408 |

| | | | | |
|---|---|---|---|---|
| 052 | Johnson City-Kingsport-Bristol, TN-VA | S | SE | 167, |
| 016 | Johnstown, PA | S | NE | 99, |
| 074 | Kalamazoo-Portage, MI | S | ENC | 117, |
| 083 | Kankakee, IL | S | ENC | 43, |
| 105 | Kansas City, MO-KS | L | WNC | 642, |
| 083 | Kenosha, WI | S | ENC | 46, |
| 124 | Killeen-Temple, TX@ | S | WSC | 108, |
| 053 | Knoxville, IN | S | SE | 200, |
| 077 | Kokomo, IN | S | ENC | 51, |
| 091 | LaCrosse, WI | S | WSC | 43, |
| 115 | Lafayette, LA | S | WSC | 65, |
| 082 | Lafayette-West Lafayette, IN | S | ENC | 55, |
| 116 | Lake Charles, LA | S | WSC | 61, |
| 044 | Lakeland-Winter Haven, FL | S | SE | 115, |
| 017 | Lancaster, PA | S | NE | 159, |
| 074 | Lansing, East Lansing, MI | S | ENC | 196, |
| 129 | Laredo, TX | S | WSC | 27, |

| | | | | |
|---|---|---|---|---|
| Lawrence, KS | S | WNC | 26,905 | 3.0930 |
| Lawton, OK | S | WSC | 52,292 | 1.2957 |
| Lewiston-Auburn, ME | S | NE | 41,313 | 1.6406 |
| Lexington-Fayette, KY | S | SE | 156,919 | 3.3285 |
| Lima, OH | S | ENC | 94,747 | 0.8655 |
| Lincoln, NE | S | WNC | 101,320 | 2.8453 |
| Little Rock-North Little Rock, AR | S | WSC | 187,959 | 2.9930 |
| Long Branch-Asbury Park, NJ | S | NE | 162,696 | 0.9683 |
| Longview, TX | S | WSC | 62,588 | 3.3084 |
| Lorain-Elyria, OH | S | ENC | 97,145 | 0.9542 |
| Los Angeles-Long Beach, CA | L | PAC | 3,423,270 | 1.6727 |
| Louisville, KY-IN | L | ENC | 406,641 | 0.7181 |
| Lubbock, TX | S | WSC | 92,404 | 4.1464 |
| Lynchburg, VA | S | SE | 72,755 | 1.8065 |
| Macon, GA | S | SE | 113,369 | 1.2872 |
| Madison, WI | S | ENC | 168,011 | 2.6990 |
| Manchester-Nashua, NH | S | NE | 120,509 | 1.9335 |

| Area Number | Region | Size* | Location | Employment |
|---|---|---|---|---|
| 065 | Mansfield, OH@ | S | ENC | 58,673 |
| 131 | McAllen-Pharr-Edinburg, TX@ | S | WSC | 73,281 |
| 042 | Melbourne-Titusville-Cocoa, FL | S | SE | 90,515 |
| 055 | Memphis-TN-AR-MS | L | ESC/WSC | 400,661 |
| 043 | Miami, FL | L | SE | 682,665 |
| 132 | Midland, TX | S | WSC | 36,060 |
| 089 | Milwaukee, WI | L | ENC | 671,969 |
| 096 | Minneapolis-St Paul, MN-WI | L | WNC/ENC | 1,019,790 |
| 047 | Mobile, AL | S | SE | 159,465 |
| 178 | Modesto, CA | S | Pac | 99,231 |
| 118 | Monroe, LA | S | WSC | 52,520 |
| 048 | Montogomery, AL | S | SE | 117,619 |
| 078 | Muncie, IN@ | S | ENC | 50,342 |
| 073 | Muskegon-Norton Shores-Muskegon Heights, MI | S | ENC | 66,401 |
| 054 | Nashville-Davidson, IN | L | SE | 380,581 |
| 012 | Nassau-Suffolk, NY | L | NE | 903,939 |
| 004 | New Bedford-Fall River, MA | S | NE | 187,235 |

| r | Region | Size | Location | Employment | Growth Rat |
|---|---|---|---|---|---|
| | New Brunswick-Perth Amboy-Sayreville, NJ | S | NE | 258,164 | 2.1927 |
| | New Haven-Waterbury-Meriden, CT | L | NE | 323,098 | 0.3366 |
| | New London-Norwich, CT | S | NE | 111,272 | 2.2807 |
| | New Orleans, LA | L | WSC | 513,662 | 2.6275 |
| | New York, NY-NJ@ | L | NE | 4,369,171 | -1.6770 |
| | Newark, NJ@ | L | NE | 930,498 | -0.1271 |
| | Nawport News-Hampton, VA | S | SE | 165,285 | 1.7246 |
| | Norfolk-Virginia Beach-Portsmouth, VA-NC | L | SE | 355,964 | 1.5633 |
| | Northeast Pennsylvania, PA | S | NE | 254,463 | 0.0559 |
| | Odessa, TX | S | WSC | 47,455 | 5.0216 |
| | Oklahoma City, OK | L | WSC | 361,199 | 1.9334 |
| | Omaha, NE-IA | S | WNC | 278,763 | 1.5167 |
| | Orlando, FL@ | S | SE | 262,744 | 5.1940 |
| | Owensboro, KY@ | S | SE | 34,813 | 0.4430 |
| | Oxnard-Simi Valley-Ventura, CA | S | Pac | 152,582 | 3.9871 |
| | Panama City, FL | S | SE | 36,837 | 3.8178 |

| | | | | |
|---|---|---|---|---|
| 047 | Pascagoula-Moss Point, MS@ | S | SE | 55,515 |
| 012 | Paterson-Clifton-Passaic, NJ@ | S | NE | 194,983 |
| 046 | Pensacola, FL | S | SE | 109,189 |
| 087 | Peoria, IL | S | ENC | 172,503 |
| 022 | Petersburg-Colonial Heights-Hopewell, VA@ | S | SE | 57,818 |
| 018 | Philadelphia, PA-NJ@ | L | NE | 2,026,371 |
| 162 | Phoenix, AZ | L | Mtn | 518,770 |
| 111 | Pine Bluff, AR | S | Mtn | 33,909 |
| 016 | Pittsburgh, PA | L | NE | 976,223 |
| 006 | Pittsfield, MA | S | NE | 65,454 |
| 002 | Portland, ME | S | NE | 115,393 |
| 172 | Portland, OR-WA | L | Pac | 525,289 |
| 012 | Poughkeepsie, NY | S | NE | 96,789 |
| 005 | Providence-Warwick-Pawtucket, RI | L | NE | 384,293 |
| 165 | Provo-Orem, UT | S | Mtn | 55,500 |
| 158 | Pueblo, CO | S | Mtn | 52,172 |

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|---|---|---|---|---|
| 027 | Raleigh-Durham, NC | S | SE | 255,686 |
| 018 | Reading, PA | S | NE | 142,578 |
| 164 | Reno, NV | S | Mtn | 86,926 |
| 169 | Richland-Kennewick, WA@ | S | WNC | 53,918 |
| 022 | Richmond, VA | L | SE | 325,001 |
| 180 | Riveraide-San Bernardino-Ontario, CA | L | Pac | 443,151 |
| 021 | Roanoke, VA | S | SE | 109,315 |
| 097 | Rochester, MN | S | WNC | 50,410 |
| 009 | Rocheater, NY | L | NE | 435,305 |
| 088 | Rockford, IL | S | ENC | 126,026 |
| 177 | Sacramento, CA | L | Pac | 383,377 |
| 072 | Saginaw, MI | S | ENC | 93,057 |
| 096 | St Cloud, MN | S | WNC | 60,551 |
| 105 | St. Joseph, MO@ | S | WNC | 43,793 |
| 107 | St. Louis, MO-IL | L | WNC/ENC | 1,064,540 |
| 172 | Salem, OR | S | Pac | 91,760 |
| 176 | Salinas-Seaaide-Monterey, CA@ | S | Pac | 133,731 |

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|---|---|---|---|---|
| 128 | San Angelo, TX | S | WSC | 35,752 |
| 129 | San Antonio, TX | L | WSC | 422,618 |
| 181 | San Diego, CA | L | Pac | 685,027 |
| 176 | San Francisco-Oakland, CA@ | L | Pac | 1,546,799 |
| 176 | San Jose, CA | L | Pac | 553,972 |
| 180 | Santa Barbara-Santa Maria-Lompoc, CA | S | Pac | 123,716 |
| 176 | Santa Cruz, CA | S | Pac | 57,739 |
| 176 | Santa Rosa, CA | S | Pac | 88,610 |
| 044 | Sarasota, FL | S | SE | 61,068 |
| 039 | Savannah, GA | S | SE | 97,418 |
| 171 | Seattle-Everett, WA | L | Pac | 657,208 |
| 125 | Sherman-Dension, TX@ | S | WSC | 35,208 |
| 117 | Shreveport, LA | S | WSC | 160,475 |
| 103 | Sioux City, IA-NE | S | WNC | 60,295 |
| 147 | Sioux Falls, SD | S | WNC | 54,839 |
| 075 | South Bend, IN | S | ENC | 123,012 |
| 168 | Spokane, WA | S | Pac | 131,293 |
| 085 | Springfield, IL | S | ENC | 97,944 |

| | | | | | |
|---|---|---|---|---|---|
| 8 | Springfield, MO | S | WNC | 89,815 | 2. |
| | Springfield, OH@ | S | ENC | 65,843 | -0. |
| 6 | Springfield-Chicopee-Holyoke, MA | S | NE | 236,304 | 0. |
| 3 | Steubenville-Weirton, OH-WV | S | ENC/SE | 69,616 | 0. |
| 8 | Stockton, CA | S | Pac | 141,188 | 3. |
| 8 | Syracuse, NY | S | NE | 266,057 | 0. |
| | Tacoma, WA@ | S | Pac | 170,110 | 0. |
| 5 | Tallahassee, FL | S | SE | 62,677 | 4. |
| 4 | Tampa-St. Petersburg, FL | L | SE | 504,194 | 3. |
| | Terre Haute, IN | S | ENC | 70,564 | 0. |
| 9 | Texarkana, TX-Texarkana, AR@ | S | WSC | 50,087 | 1. |
| 0 | Toledo, OH-MI | L | ENC | 318,179 | 0. |
| | Topeka, KS@ | S | WNC | 90,710 | 0. |
| 3 | Trenton, NJ | S | NE | 167,285 | 1. |
| | Tucson, AZ | S | Mtn | 172,708 | 3. |
| | Tulsa, OK | S | WSC | 290,637 | 4. |
| | Tuscaloosa, AL | S | SE | 53,600 | 2. |
| 0 | Tyler, TX | S | WSC | 52,679 | 3. |

| | | | | |
|---|---|---|---|---|
| 176 | Vallejo-Fairfield-Napa, CA | S | Pac | 115,183 |
| 018 | Vineland-Millville-Bridgeton, NJ | S | NE | 58,242 |
| 124 | Waco, TX | S | WSC | 71,325 |
| 020 | Washington, DC-MD-VA | L | SE | 1,590,643 |
| 101 | Waterloo-Cedar Falls, IA | S | WNC | 66,539 |
| 043 | West Palm Beach, Boca Raton, FL | S | SE | 179,249 |
| 063 | Wheeling, WV-OH | S | ENC | 73,868 |
| 139 | Wichita, KS | S | WNC | 207,349 |
| 126 | Wichita Falls, TX@ | S | WSC | 66,416 |
| 014 | Williamsport, PA | S | NE | 51,566 |
| 018 | Wilmington, DE-NJ-MD | S | SE | 239,178 |
| 025 | Wilmington, NC | S | SE | 54,392 |
| 004 | Worcester-Fitchburg-Leominster, MA | S | NE | 272,506 |
| 170 | Yakima, WA | S | Pac | 73,466 |
| 017 | York, PA | S | NE | 156,469 |
| 064 | Youngstown-Warren, OH | S | ENC | 222,031 |

SE = Southeast

ENC = East North Central

WNC = West North Central

WSC = West South Central

Mtn = Mountain

Pac = Pacific

areas excluded on the basis of statistical consideration.

| | | | | |
|---|---|---|---|---|
| 2 | Portland-Lewiston, ME | S | NE | 162,137 |
| 3 | Burlington, VT | L | NE | 186,299 |
| 4 | Boston, MA@ | S | NE | 165,701 |
| 5 | Providence-Warwick-Pawtucket, RI@ | S | NE | 29,360 |
| 6 | Hartford-New Haven-Springfield, CT-MA | S | NE | 162,155 |
| 7 | Albany-Schenectady-Troy, NY | S | NE | 159,447 |
| 8 | Syracuse-Utica, NY | S | NE | 139,027 |
| 9 | Rochester, NY | S | NE | 44,885 |
| 10 | Buffalo, NY | S | NE | 145,280 |
| 11 | Binghamton-Elmira, NY | S | NE | 174,019 |
| 12 | New York, NY | L | NE | 303,427 |
| 13 | Scranton-Wilkes-Barre, PA | S | NE | 46,911 |
| 14 | Williamsport, PA | L | NE | 198,768 |
| 15 | Erie, PA | S | NE | 95,050 |
| 16 | Pittsburgh, PA | L | NE | 218,045 |
| 17 | Harrisburg-York-Lancester, PA | S | NE | 133,592 |

| | | | | |
|---|---|---|---|---|
| Philadelphia, PA | L | NE | 358,003 | 0.8701 |
| Baltimore, MD | S | SE | 123,371 | 1.9186 |
| Washington, DC | L | SE | 263,869 | 1.7576 |
| Roanoke-Lynchburg, VA | L | SE | 312,266 | 1.4579 |
| Richmond, VA | S | SE | 172,743 | 1.6454 |
| Norfolk-Virginia Beach-Newport News, VA | S | SE | 69,873 | 1.8020 |
| Rocky Mount-Wilson-Greenville, NC | L | SE | 334,569 | 2.3502 |
| Wilmington, NC | S | SE | 104,106 | 0.6603 |
| Fayetteville, NC | S | SE | 105,457 | 1.9268 |
| Raleigh-Durham, NC | S | SE | 139,524 | 1.6633 |
| Greensboro-Winston-Salem-High Point, NC | S | SE | 158,422 | 1.6130 |
| Charlotte, NC | L | SE | 424,838 | 1.1374 |
| Asheville, NC | S | SE | 106,664 | 2.3578 |
| Greenville-Spartanburg, SC | S | SE | 171,520 | 1.2994 |
| Columbia, SC | S | SE | 136,958 | 1.8967 |
| Florence, SC | L | SE | 197,484 | 2.1233 |

| | | | | |
|---|---|---|---|---|
| | Charleston, SC | S | SE | 11,456 |
| 35 | Augusta, GA | S | SE | 69,394 |
| 36 | Atlanta, GA | L | SE | 332,446 |
| 37 | Columbua, GA | S | SE | 97,939 |
| 38 | Macon, GA@ | S | SE | 92,975 |
| 39 | Savannah, GA | S | SE | 138,923 |
| 40 | Albany, GA | S | SE | 158,649 |
| 41 | Jacksonville, FL | S | SE | 137,772 |
| 42 | Orlando-Melbourne-Daytona Beach, FL | S | SE | 40,615 |
| 43 | Miami-Fort Lauderdale, FL | S | SE | 99,582 |
| 44 | Tampa-St. Petersburg, FL@ | S | SE | 74,645 |
| 45 | Tallahassee, FL | S | SE | 47,366 |
| 46 | Penaacola-Panama City, FL | S | SE | 59,729 |
| 47 | Mobile, AL | S | SE | 68,703 |
| 48 | Montogomery, AL | L | SE | 200,601 |
| 49 | Birmingham, AL | S | SE | 142,237 |
| 50 | Huntsville-Florence, AL | S | SE | 67,654 |

| | | | | | |
|---|---|---|---|---|---|
| 51 | Chattanooga, TN | S | SE | 163,634 | 3 |
| 52 | Johnson City-Kingsport-Bristol, TN,VA | S | SE | 151,991 | 2 |
| 53 | Knoxville, TN | L | SE | 186,650 | 2 |
| 54 | Naahville, TN | L | SE | 312,453 | 2 |
| 55 | Memphis, TN | L | SE | 679,883 | 1 |
| 56 | Paducah, KY | S | SE | 96,726 | 1 |
| 57 | Louisville, KY | S | SE | 148,780 | 0 |
| 58 | Lexington, KY | L | SE | 197,546 | 2 |
| 59 | Huntington, WV | S | SE | 108,659 | 3 |
| 60 | Charleston, WV | S | SE | 123,805 | 3 |
| 61 | Morganton-Fairmont, WV | S | SE | 130,504 | 1 |
| 62 | Parkeraburg, WV@ | S | SE | 8,099 | 4 |
| 63 | Wheeling-Steubenville-Wierton, WV-OH | S | SE/ENC | 24,333 | 1 |
| 64 | Youngstown-Warren, OH | S | ENC | 122,136 | 0 |
| 65 | Cleveland, OH | L | ENC | 234,857 | 1 |
| 66 | Columbus, OH | L | ENC | 287,287 | 0 |
| 67 | Cincinnati, OH | S | ENC | 103,700 | 1 |

| | | | | |
|---|---|---|---|---|
| 68 | Dayton, OH | S | ENC | 55,019 |
| 69 | Lima, OH | S | ENC | 28,164 |
| 70 | Toledo, OH | S | ENC | 136,479 |
| 71 | Detroit, MI | S | ENC | 13,507 |
| 72 | Saginaw-Bay City, MI | L | ENC | 185,052 |
| 73 | Grand Rapida, MI | S | ENC | 149,017 |
| 74 | Lansing-Kalamazoo, MI | S | ENC | 30,631 |
| 75 | South Bend, IN | L | ENC | 228,277 |
| 76 | Fort Wayne, IN | S | ENC | 90,883 |
| 77 | Kokomo-Marion, IN | S | ENC | 88,965 |
| 79 | Indianapolis, IN | S | ENC | 126,365 |
| 80 | Evansville, IN | S | ENC | 152,542 |
| 81 | Terre Haute, IN | S | ENC | 21,223 |
| 82 | Lafayette, IN | S | ENC | 60,183 |
| 83 | Chicago, IL | L | ENC | 225,685 |
| 84 | Champaign-Urbana, IL | S | ENC | 101,880 |
| 85 | Springfield-Decatur, IL | S | ENC | 76,158 |
| 86 | Quincy, IL | S | ENC | 70,787 |

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|---|---|---|---|---|
| 87 | Peoria, IL | S | ENC | 87,833 |
| 88 | Rockford, IL | S | ENC | 115,482 |
| 89 | Milwaukee, WI | S | ENC | 132,701 |
| 90 | Madison, WI | S | ENC | 77,059 |
| 91 | LaCrosse, WI | S | ENC | 84,276 |
| 92 | EauClaire, WI | S | ENC | 46,576 |
| 93 | Wausau, WI | S | ENC | 165,467 |
| 94 | Appleton-Green Bay-Oshkosh, WI | L | ENC | 258,999 |
| 95 | Duluth, MN | S | WNC | 62,784 |
| 96 | Minneapolis-St Paul, MN | L | WNC | 344,602 |
| 97 | Rochester, MN | S | WNC | 73,265 |
| 98 | Dubuque, IA | S | WNC | 83,188 |
| 99 | Davenport-Rock Island-Moline, IN-IL | S | WNL/ENC | 157,210 |
| 100 | Cedar Rapids, IA | S | WNC | 81,173 |
| 101 | Waterloo, IA | S | WNC | 129,572 |
| 102 | Fort Dodge, IA | S | WNC | 130,548 |
| 103 | Sioux City, IA | S | WNC | 133,113 |
| 104 | Des Moines, IA | L | WNC | 221,672 |

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|---|---|---|---|---|
| 105 | Kansas City, MO | L | WNC | 201,923 |
| 106 | Columbia, MO | S | WNC | 151,934 |
| 107 | St. Louis, MO | L | WNC | 404,747 |
| 108 | Springfield, MO | L | WNC | 303,226 |
| 109 | Fayetteville, AR@ | S | WSC | 47,320 |
| 110 | Fort Smith, AR | S | WSC | 62,287 |
| 111 | Little Rock, North Little Rock, AR | L | WSC | 273,340 |
| 112 | Jackson, MS | L | SE | 290,753 |
| 113 | New Orleans, LA | L | WSC | 223,124 |
| 114 | Baton Rouge, LA | S | WSC | 65,948 |
| 115 | Lafayette, LA | S | WSC | 130,870 |
| 116 | Lake Charles, LA@ | S | WSC | 48,440 |
| 117 | Shreveport, LA | S | WSC | 54,370 |
| 118 | Monroe, LA | S | WSC | 78,978 |
| 119 | Texarkana, TX | S | WSC | 91,971 |
| 120 | Tyler-Longview, TX | S | WSC | 133,199 |
| 121 | Beaumont-Port Arthur, TX | S | WSC | 17,614 |
| 122 | Houston, TX | S | WSC | 171,822 |
| 123 | Austin, TX | S | WSC | 27,429 |

| | | | | | |
|---|---|---|---|---|---|
| 24 | Waco-Killeen-Temple, TX | S | WSC | 51,925 | 0 |
| 25 | Dallas-Fort Worth, TX | S | WSC | 119,864 | 1 |
| 26 | Wichita Falls, TX | S | WSC | 24,367 | 1 |
| 27 | Abilene, TX | S | WSC | 65,548 | 1 |
| 28 | San Angelo, TX | S | WSC | 27,026 | 1 |
| 29 | San Antonio, TX | S | WSC | 100,356 | 2 |
| 30 | Corpus Christi, TX | S | WSC | 50,134 | 0 |
| 1 | Brownsville-McAllen-Harlingen, TX | S | WSC | 9,686 | 3 |
| 32 | Odessa-Midland, TX | S | WSC | 48,948 | 1 |
| 33 | El Paso, TX | S | WSC | 114,735 | 2 |
| 34 | Lubbock, TX | S | WSC | 102,486 | 1 |
| 35 | Amarillo, TX | S | WSC | 134,922 | 2 |
| 6 | Lawton, OK | S | WSC | 53,273 | 1 |
| 37 | Oklahoma City, OK | L | WSC | 215,773 | 2 |
| 38 | Tulsa, OK | S | WSC | 131,265 | 2 |
| 39 | Wichita, KS | L | WNC | 218,327 | 2 |
| 40 | Salina, KS | S | WNC | 120,256 | 2 |
| 41 | Topeka, KS | S | WNC | 101,663 | 0 |

| | | | | |
|---|---|---|---|---|
| 142 | Lincoln, NE | S | WNC | 76,160 |
| 143 | Omaha, NE | S | WNC | 117,348 |
| 144 | Grand Island, NE | S | WNC | 174,906 |
| 145 | Scotts Bluff, NE | S | WNC | 50,619 |
| 146 | Rapid City, SD | S | WNC | 108,131 |
| 147 | Sioux Falls, SD | S | WNC | 151,596 |
| 148 | Aberdeen, SD | S | WNC | 61,653 |
| 149 | Fargo-Moorhead, NE-MN | S | WNC | 92,707 |
| 150 | Grand Folks, ND | S | WNC | 86,294 |
| 151 | Bismarck, ND | S | WNC | 70,528 |
| 152 | Minot, ND | S | WNC | 87,247 |
| 153 | Great Falls, MT@ | S | Mtn | 67,477 |
| 154 | Missoula, MT | S | Mtn | 101,193 |
| 155 | Billings, MT | S | Mtn | 88,144 |
| 156 | Cheyenne-Casper, WY | S | Mtn | 84,777 |
| 157 | Denver, CO | S | Mtn | 47,043 |
| 158 | Colorado Springs-Pueblo, CO | S | Mtn | 65,393 |
| 159 | Grand Junction, CO@ | S | Mtn | 107,864 |
| 160 | Albuquerque, NM | S | Mtn | 136,027 |

| r | Region | Size* | Location** | 1976 Employment | 1971-1976 Growth Rat |
|---|---|---|---|---|---|
| | Tucson, AZ@ | S | Mtn | 45,790 | 0.8944 |
| | Phoenix, AZ | S | Mtn | 153,481 | 3.3128 |
| | Las Vegas, NV@ | S | Mtn | 23,871 | 1.4346 |
| | Reno, NV | S | Mtn | 55,037 | 4.0601 |
| | Salt Lake City-Ogden, UT | S | Mtn | 115,848 | 5.2319 |
| | Pocatello-Idaho Falls, ID | S | Mtn | 168,619 | 4.8206 |
| | Boise City, ID | S | Mtn | 80,958 | 3.6089 |
| | Spokane, WA | S | Pac | 125,894 | 2.8469 |
| | Richland, WA | S | Pac | 73,369 | 3.2888 |
| | Yakima, WA | S | Pac | 79,435 | 3.4552 |
| | Seattle, WA | L | Pac | 250,376 | 3.4352 |
| | Portland, OR | L | Pac | 204,889 | 3.4508 |
| | Eugene, OR | S | Pac | 148,145 | 3.0841 |
| | Redding, CA | S | Pac | 81,508 | 3.5842 |
| | Eureka, CA | S | Pac | 53,033 | 2.8287 |
| | San Francisco-Oakland-San Jose, CA | S | Pac | 43,739 | 5.5525 |
| | Sacramento, CA | S | Pac | 135,731 | 4.5009 |

| Area Number | Region | Size | Location | Employment | G |
|---|---|---|---|---|---|
| 178 | Stockton-Modesto, CA | S | Pac | 81,951 | |
| 179 | Fresno-Bakersfield, CA | S | Pac | 149,703 | |
| 180 | Los Angeles, CA | S | Pac | 59,309 | |
| 181 | San Diego, CA@ | S | Pac | 45,247 | |
| 182 | Anchorage, AK@ | S | Pac | 120,879 | |
| 183 | Honolulu, HI | S | Pac | 80,102 | |

* S = Small

* L = Large Non-SMSA's are those with 1976 employment levels above 18

** Legend NE = Northeast

SE = Southeast

ENC = East North Central

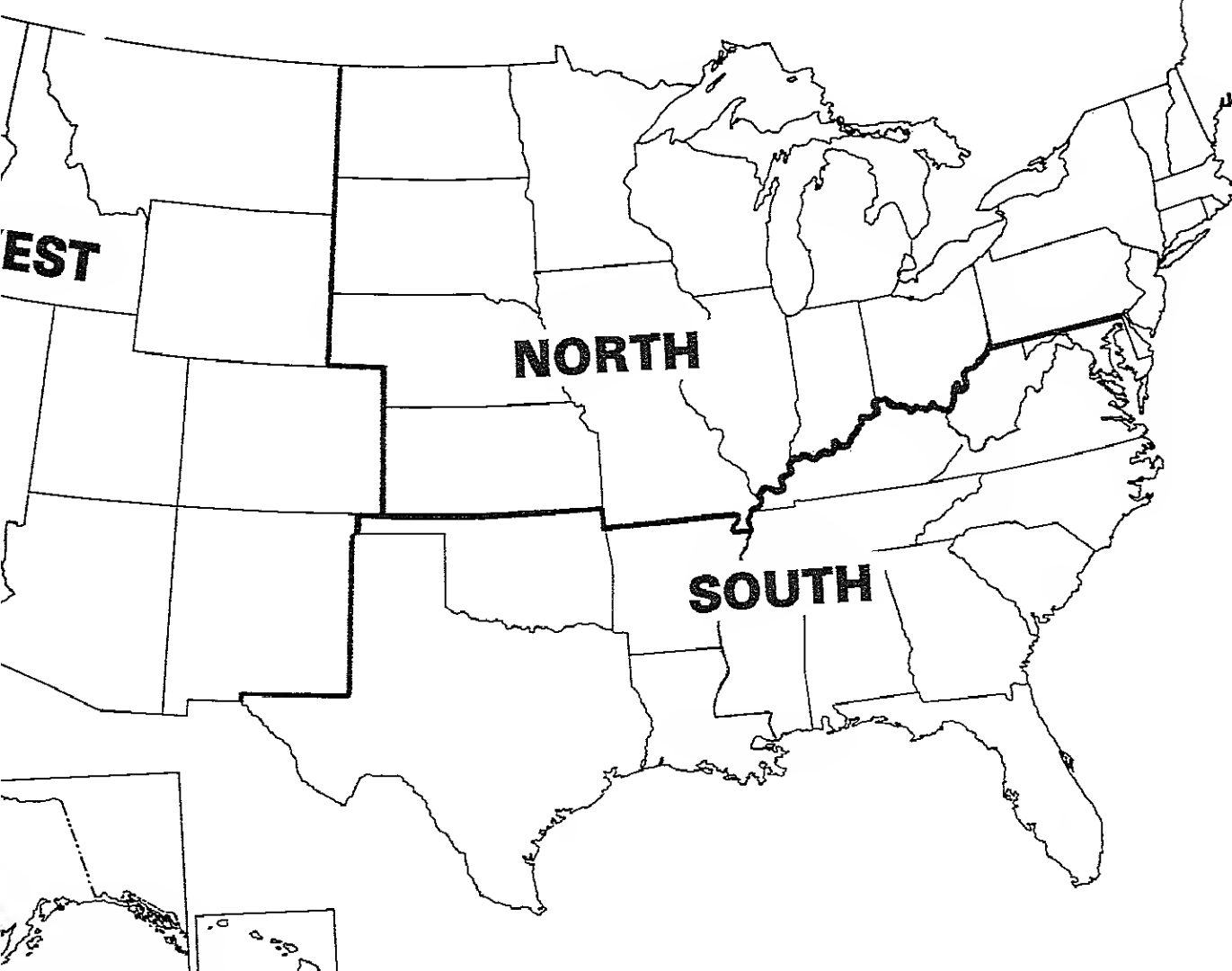
WNC = West North Central

WSC = West South Central

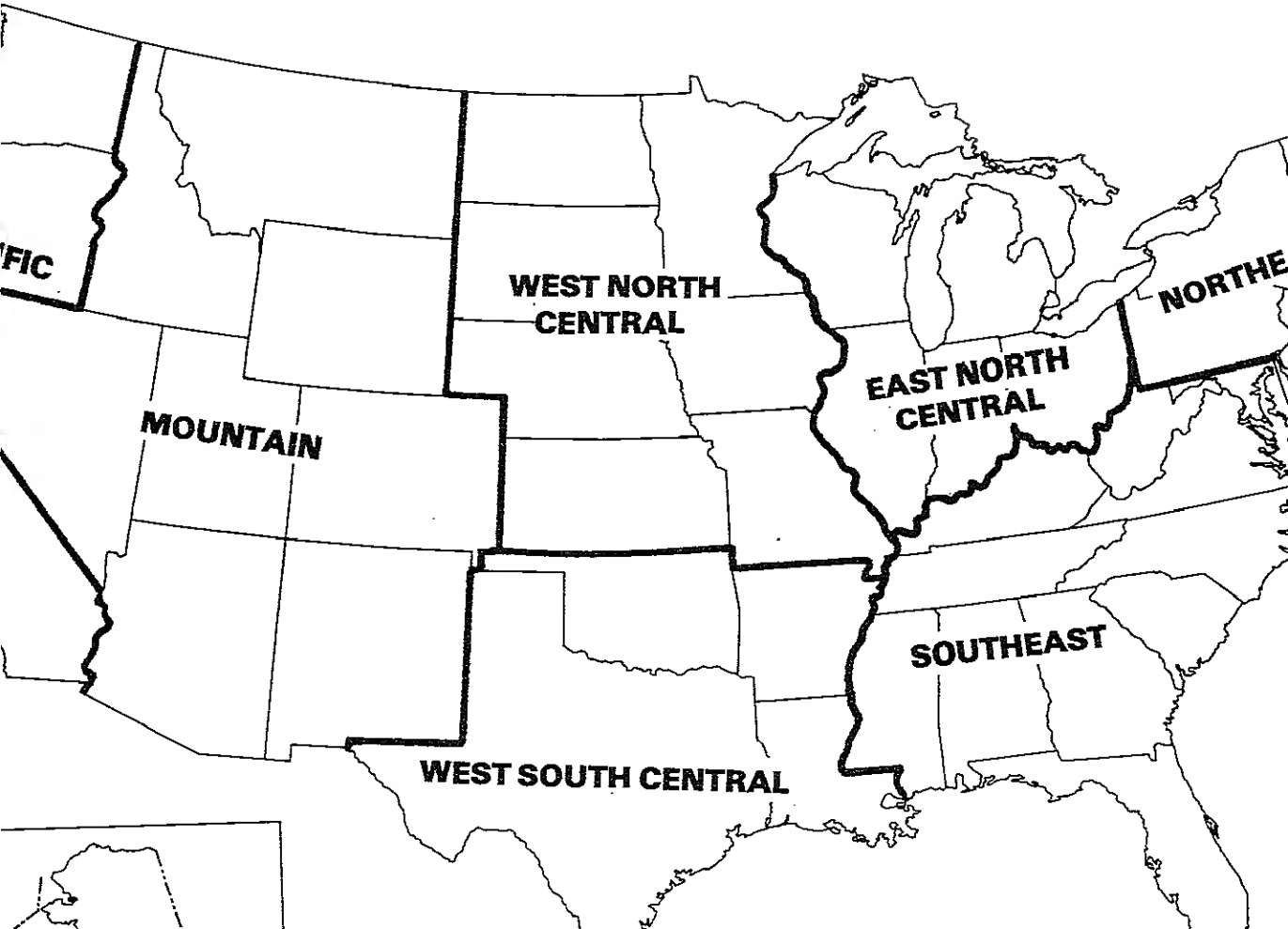
Mtn = Mountain

Pac = Pacific

@ = areas excluded on the basis of statistical consideration.


EST
NORTH
SOUTH

## Figure E-2: Regions Delineated for Small SMSAs



## Figure E-3: Regions Delineated for Small Non-SMSAs